



Subject DC-DC converter in the Hydraulic Management Module

Affected E1 Antares
Serial no. 01 bis 03, 06 bis 12, 18, 19, 22, 23, 25, 32E30 bis 40E38, 42E39, 44E40, 45E41, 901

Date 06 July 2008

Urgency Level 1: Before next flight
Level 2: Will be announced

Reason A massive short circuit occurred during the operation of an E1 Antares. The short circuit was located in the DC-DC converter which supplies power to the hydraulic pump, and it lead to the DC-DC converter becoming inoperable. The heat generated during the failure of the DC-DC converter also lead to the adjacently positioned Hydraulic Management Module being damaged to such an extent that micro-switch positions in the whole engine-bay could no longer be recorded. Consequentially, the position of the motor pylon (retracted, extended or in an in-between position) could no longer be determined, and the running motor was switched off as a safety precaution. The pilot could glide to the nearest airfield and landed safely.

An analysis of the incidence showed that current fluctuations occurring in the drive battery led to the failure of the DC-DC converter. The analysis also showed that the current design has an elevated risk for failure of the DC-DC converter.

The main risk resulting from the aforementioned failure scenario is not the loss of the DC-DC converter, but rather the damage to the Hydraulic Management Module, as this can lead to the complete loss of motor-power.

If the DC-DC converter fails without damaging the Hydraulic Management Module, the following hydraulically executed functions will no longer be available: "Extend motor", "Retract motor" and "Retract landing gear".

In such a situation, the following scenarios are possible:

- a. The aircraft is in powered flight, and the motor cannot be retracted as planned.
If enough battery energy is still available in the drive batteries, then the aircraft can fly to the closest airfield and perform a safety landing.
If the drive battery has been fully discharged, then the aircraft must continue the flight with a wind-milling motor. In this configuration the best glide ratio is approximately 1:27 at 110 km/h (60 kt.). The sink rate is approximately 1.1 m/s (217 ft/min). For powered gliders, the motor is typically put into operation at (for a self-launch) or near (for an air-start) an (out-) landing field. In such a failure scenario, it should be possible to safely reach this field.
- b. The aircraft is in soaring configuration, and the motor cannot be extended. An out-landing should be executed at the planned out-landing field.
- c. The landing gear cannot be retracted. The aircraft performance is degraded by approximately 5 to 10%. This should be taken into consideration if the flight is continued. The function "extend landing gear" is still available since it does not require hydraulic power.

Based on these considerations, it is chosen to make this technical note a two level procedure.

Level I: The integration of a fuse on the DC-DC converter supply cable

The DC-DC converter supply cable is equipped with a fuse. This fuse will, in the case of a short circuit, prevent over-current and over-voltage which could lead to damage to the adjacent Hydraulic Management Module.

When the aircraft is flown in this configuration, then it must be taken into consideration that there is an elevated risk for the loss of the DC-DC converter, which would lead to the loss of the following functions:

- Extend motor
- Retract motor
- Retract landing gear

The owner of the aircraft must ensure that all people flying the aircraft are made aware of this Technical Note prior to their next flight.

Level II: The integration of an input attenuator module

The power supply to the DC-DC converter is equipped with an input attenuator module. The task of this module is to eliminate voltage fluctuations, and so to restore the accustomed high system reliability.

Actions

Carefully read through the entire Technical Note prior to the implementation of the described actions.

Level I: The integration of a fuse on the DC-DC converter supply cable

The integration of a fuse on the DC-DC converter supply cable is performed by installing an additional cable with an integrated fuse.

The following procedural steps must be performed:

1. Extend the motor.

Extend the motor and leave it in maintenance position (motor extended, motor bay covers open) as described in the flight manual.

If the aircraft is not rigged, the motor extension can be performed using 12V power supplied through the maintenance sockets in the left leg-rest. Do not extend the engine using wing power from the "Trailer charge" socket.

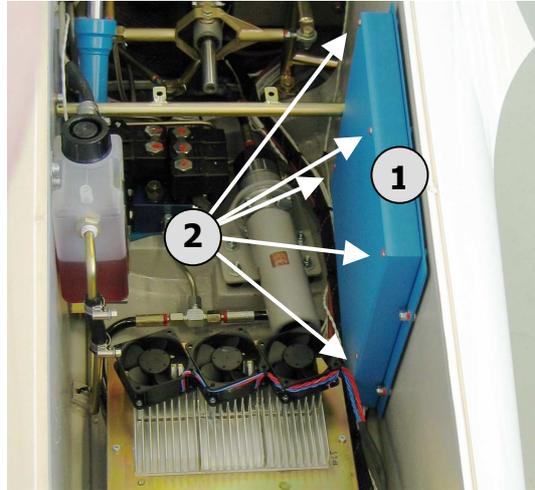
2. Disconnect the aircraft from all power sources

- a. Turn the key switch to the position off and remove the key. Wait until the system has fully shut down (display is off).
- b. Disconnect both drive battery connectors (located in the wing roots).
- c. Disconnect 230 /110V power-grid connector from its (blue) socket in the forward bulkhead.
- d. Disconnect the "Trailer charge" connector from its (metallic/black) socket in the forward bulkhead

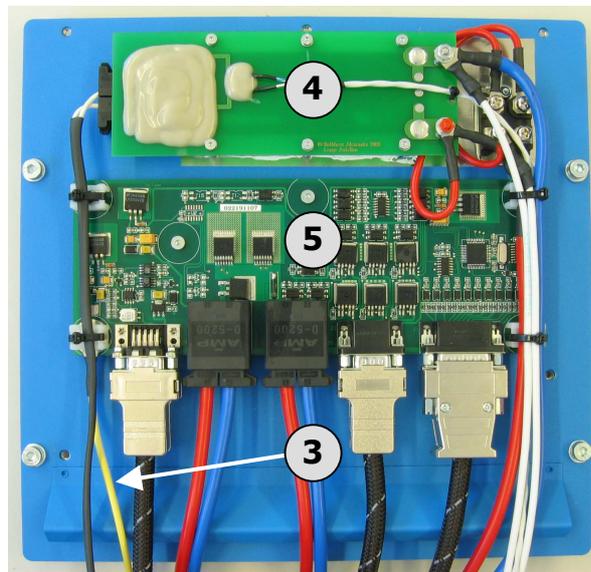
3. Remove the module housing cover

The DC-DC converter and the Hydraulic Management Module share a common housing ① located at the right engine bay wall.

In this procedural step the cover is removed from the common housing.



- a. Using an Allen wrench, remove the 5 screws ② (M4) holding the cover in place, and carefully remove the cover
- b. Disconnect the yellow grounding cable ③ from the cover and store the cover safely.



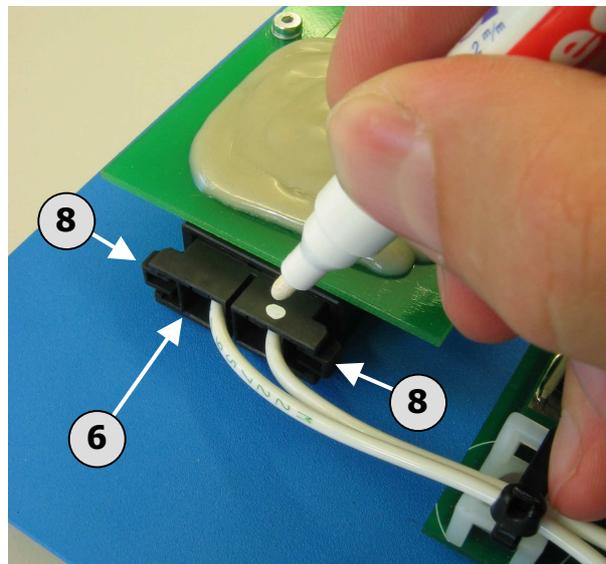
The picture shows the DC-DC converter ④ and Hydraulic Management Module ⑤ after the removal of the cover.

Depending on the specific aircraft in question, there may be slight discrepancies between picture and aircraft.

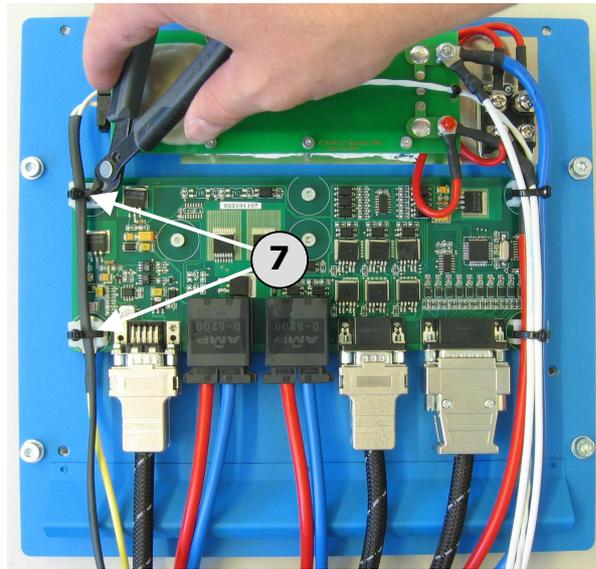
3. Modification of the supply cable

The DC-DC converter is supplied by the drive battery. In this procedural step the supply cable which connects the DC-DC converter to the drive battery is modified to integrate a fuse..

- a. Mark the plug-in position for the lower cable on the connector housing ⑥.

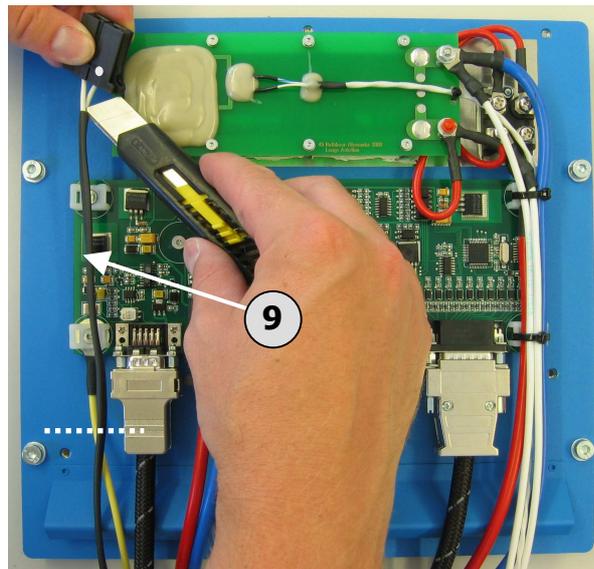


- b. Remove both cable ties ⑦ using a pair of side-cutting pliers.

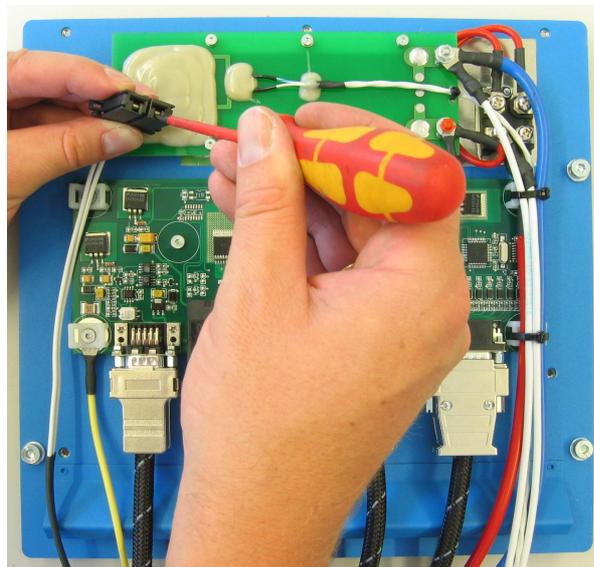


- c. Disconnect the supply cable from the DC-DC converter socket. To release the connector press both securing latches ⑧ together and keep them pressed while connector housing is pulled out of the socket.
- d. Use a voltmeter to measure the voltage over the two supply cable connectors. Set the voltmeter to a DC range which covers up to 300V. The measured voltage must be lower than 2V. Contact the manufacturer if this is not the case, then.
- e. Use a knife to remove the heat shrinking tube (9) from the supply cable as far as indicated by the dashed white line in the picture below.

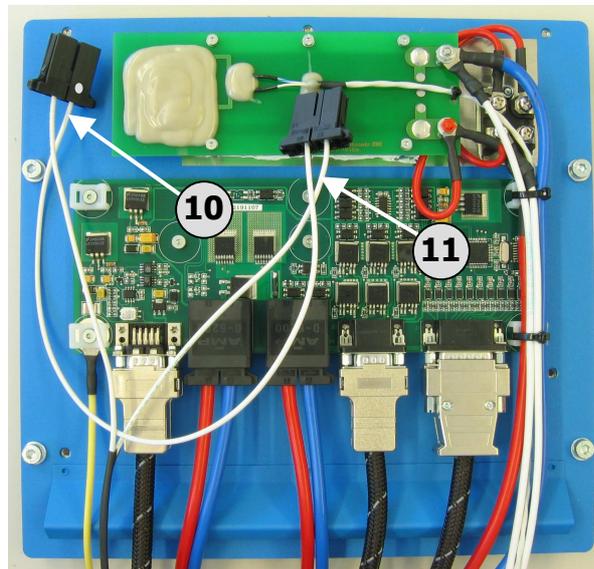
Attention: It is of high importance that the white insulation of the individual cables is not damaged by the knife while removing the heat shrink tube.



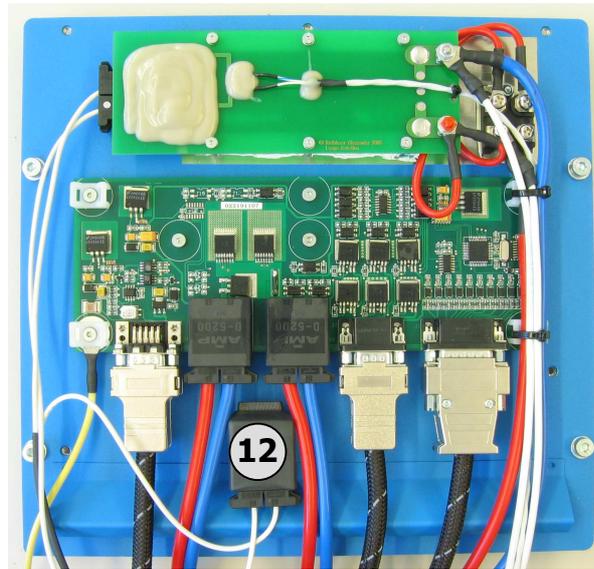
- f. Remove the connector from the plug-in position in the connector housing marked in procedural step 3.a. Insert a small slotted screwdriver into the connector housing and press the securing latch down and away from the connector (see sketch). While doing so, pull the connector out of the connector housing.



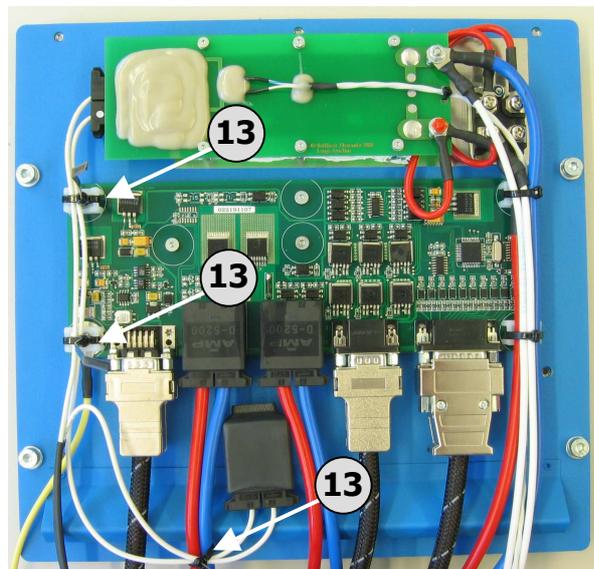
- g. In this procedural step, an additional connector is integrated into the supply cable. The manufacturer supplies a cable with connector for this purpose. This cable has one free connector ⑩. Insert this free connector into the now free plug-in position, which was marked in procedural step 3.a. Make sure that the securing latch engages the connector so that it can no longer be pulled out of the connector housing. Insert the free supply cable connector (11) into the free plug in position of the new connector. Make sure that the securing latch engages the connector that it can no longer be pulled out of the connector housing.



- h. Insert the marked (old) connector back into the DC-DC converter socket. Make sure that the securing latches engage the socket so that the connector can no longer be pulled out of the socket.
- i. Insert the new connector into the fuse (12) provided by manufacturer. Make sure that the securing latches engage the socket so that the connector can no longer be pulled out of the socket.
- j. Remove the sheet from the tacky tape on the fuse and use the tape to position the fuse as shown in the picture below.



- k. Use the three cable ties (13) provided by manufacturer to secure the loose cables in position as shown in the picture below.



- l. Reconnect the grounding cable to the housing cover.
- m. Reinstall the 5 screws that hold the housing cover in place. Use Loctite 243 (normal blue Loctite) to secure, and apply inspection lacquer to the screw heads.

Attention: Attention must be paid to that no cable is crushed when the cover is put in place.

4. Final functional test

- a. Reconnect both drive battery connectors.
- b. Insert and turn the keys-witch to the position "on". Wait until the system has completed booting
- c. Use the single lever control to fully extend and retract the motor three times. Observe the common housing of the DC-DC converter and the Hydraulic Management Module while these operations take place. If no abnormalities can be detected, the modification is concluded. Contact manufacturer if any abnormalities are detected.

5. Instruction of pilots

The owner of the aircraft must ensure that all people flying the aircraft are made aware of this Technical Note prior to their next flight.

In particular the pilots must be made aware of the elevated danger of DC-DC converter failure, the effect this has on the hydraulic pump, and the possible in flight scenarios as described in this Technical Note under the paragraph "Reason".

Level II: The integration of an input attenuator module

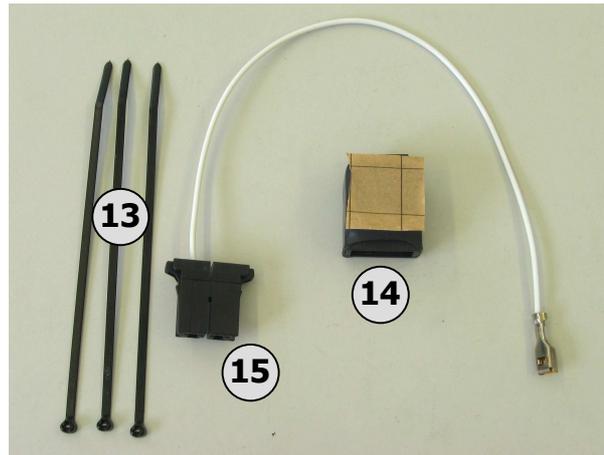
The final solution, which requires the integration of an input attenuator module is currently in development. Further actions will be announced as soon as the development has been completed.

Level II can presumably only be performed by a company that has been approved by the manufacturer.

Materials

The manufacturer provides a material-kit for this Technical Note, which consists of the following items:

- 3 Cable ties (13)
- 1 Fuse (14)
- 1 Cable with connector (15)



The material kit can be obtained from the following address:

Lange Aviation GmbH
Brüsseler Str. 30
66482 Zweibrücken
Deutschland

Tel.: ++49 63 32 96 27 0
Fax.: ++49 63 32 96 27 19
e-mail: info@lange-aviation.com

Furthermore the following materials are needed::

- Medium strength threadlocker Loctite 243
- Inspection lacquer (red)

Tools

Allen wrenches (3, 4 and 5mm), a pair of side-cutting pliers, a slotted screwdriver (Slot width: 2mm), a knife, a voltmeter.

Mass

The change of mass is negligible.



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Technische Mitteilung Nr. 904-2
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C.G. position The change of the C.G. position is negligible.

Note The action may be accomplished by a qualified person. The action must be documented in the aircraft log book

Zweibrücken, den 13.08.2008

Braunschweig, den 13.08.2008

Lange Flugzeugbau GmbH

Luftfahrt-Bundesamt

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13.08.2008