

PFR-34 Title: DAP SN83 tripped IDPU supplies during turn on

Assembly : DAP SN083		SubAssembly :		
Component :		Date: March 1, 2005		
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uilure Occurred D Functional test	Puring (Check one $$) Qualification test	□ S/C Integration	□ Launch operations	
Environment when failure occurred:				
Ambient	□ Vibration	□ Shock		
Thermal		□ Thermal-Vacuum	□ EMI/EMC	
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Problem Description

(In this section it is important to document the specific symptoms, which exhibited the problem. In the event we see it happen again, we would like to know as much as possible.)

On 3/1/05, a DCB/DAP integration test was performed. Equipment used included DCB SN003, PCB SN004, LVPS simulator SN007, and DAP SN083 on extender card. Test setup included a GSE rack with ETU backplane. During first power on of DAP, GSE readbacks displayed that PCB circuit breakers for IDPU_P5VA, and IDPU_M5VA had tripped. It was confirmed that instrument voltages and IDPU voltages were tripped off by probing the supply lines while the DAP was on the extender card. The PCB circuit breakers would turn off the IDPU supplies during power on because of in rush current. This is a documented problem associated with the DAP board. On the ETU, the problem was circumvented by forcing on the IDPU supplies before DAP power on and then removing the force by pulsing on the supplies.

Analyses Performed to Determine Cause

(How do we know how the failure happened? Was it a bad part, bad handling, what?)

Current profiles were taken on all SST supplies. The most significant current inrush was M5VA. The current spike was about 5A and 2A on the P5VA. Both measurements were taken at the output of the PCB switches. On the PCB layout, a capacitor was included by design to negate the latch for the PCB supply circuit breakers. Capacitors, .02uF, were installed on PCB ETU 2B P5VA and M5VA supply line. During power on using the LVPS simulator, PCB circuit breakers did not shut down IDPU supplies. The capacitors allowed the circuit breakers to ignore current for 1.2ms (twice the current spike duration). After successful turn ons, SN083 DAP was installed into the IDPU ETU using the LVPS ETU on 3/14/05. During power on of the flight DAP, the IDPU P5VA, M5VA, and P10VA tripped. The latch capacitors were changed to a larger value of .1uF and installed on P5VA, M5VA, and P10VA. The change in capacitance allowed 2ms to negate the PCB circuit breaker latches. Subsequent DAP turn on with the IDPU ETU unit, the P10VA turned off while the P5VA turned on to 4V. M5VA turned on successfully.

The LVPS uses the same transformer for the +/- 12VA, +/-10VA, and +/-5VA. To control circuit breaker logic, the +/-12VA and +/-10VA are used as supply lines for op amps. Large amounts of capacitance were used as 'hold up' caps for the supply lines. To test the idea, 120uF was soldered onto the supply lines of the headroom voltages using PCB ETU 2B on 3/15/05. When the DAP was powered on, the P10VA no longer tripped off, but the P5VA stayed at 4V until the supplies were repulsed. 100uF were soldered onto the +/-10VA supply. The power on sequence worked intermittently. The DAP could not be turned on/off



immediately because the caps needed to discharge for about 10 seconds. The turn on sequence would succeed repeatedly but would not work after a long period of discharge time.

Due to design constraints on the LVPS, the solutions needed to implement the DAP inrush current problem became impractical. With six months of history turning on the DAP with forced supplies and then pulsing the supplies, the solution was no longer pursued. It is an operational constraint.

Corrective Action/ Resolution

(How do we fix the unit? And how do we make sure it doesn't happen again?)

.1uF capacitors were installed on all IDPU supply lines in the PCB to help dampen inrush current during instrument power on. To ensure a proper turn on of the SST, use SST_ON.CMD. The script will execute force on supplies, power on SST, and pulse supplies. This ensures a proper turn on when using the flight instrument.

Acceptance:	
MAM: Ron Jackson	; IDPU: Michael Ludlam
PM: Peter Harvey	· Cognizant Engineer
	, cognizant Engineer

Date of Closure_____