Current Carrying Capacity of CompactPCI® Connectors

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Agenda

What are compactPCI® connectors and why is JPL using them?

What is current carrying capacity?
- What are the test requirements?
- What was the test procedure?
- What are the results?
- What is the next step?
CompactPCI® Connector

PCI - Peripheral Component Interconnect

Press Fit

Material

- Connector Body (glass filled polyester housing)
- Pin (phosphor-bronze with Ni and Au plating)

- High Pin Count (110 pins per connector)
CompactPCI® Connectors for Space Flight Use

Smaller more compact electronics

- higher density of input/outputs
- high speed interface bus

Launching spacecraft more frequently

- commercial parts
- use plug and play with ground support equipment

Validate compactPCI® connectors for use in space flight
Current Carrying Capacity

Amount of current a connector pin can carry before the temperature of the connector rises above the manufacturer’s suggested temperature limit (in the case, 125°C)

Data taken when current is simultaneously flowing through all the pins
Current Carrying Capacity

For example: If the connector is at an ambient of 70°C, 1 A of current will increase the temperature of the connector to 125°C.

Figure 52 – Current-carrying capacity: derating curves for different contact arrangements
## Current Carrying Capacity of Vendors

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Current-Carrying Capacity in Air (all pins carrying current)</th>
<th>Vendor’s Maximum, Recommended Temperature of the Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor 1</td>
<td>1 A @ 70°C</td>
<td>125°C</td>
</tr>
<tr>
<td>Vendor 2</td>
<td>1 A @ 70°C</td>
<td>125°C</td>
</tr>
<tr>
<td>Vendor 3</td>
<td>1.5 A @ 70°C</td>
<td>125°C</td>
</tr>
</tbody>
</table>

Data (in air) specified is from the manufacturer’s data sheets
Test Requirements

Conditions of space environment (vacuum)

- The connector’s ambient temperature in space is 70°C
- 1 A of current is required to flow through the connector

To simplify this test, the evaluation was done in air
Test Requirements

JPL's requirement for de-rating of air for space application is 60%

With de-rating, the connector must have a current capacity of 1.7 A at room temperature

- Ambient temperature of connectors in space is 70°C

- The connectors were tested such that the minimum temperature increase was 55°C

- This met the manufacturer's required maximum of 125°C
Test Setup

Test Articles

- 3 backplanes: each consisting of the 3 vendors connectors
- 3 cards: one for each backplane
- Connectors were press fit and soldered
Test Setup

Thermocouples
- Each card had 4 thermocouples attached to the connector
- Each backplane had 4 thermocouples attached to each connector (total of 12 thermocouples)

Equipment
- Data Acquisition - Delta Logger (Temp and Volt Measurements)
- Power Supply
- High Precision Shunt Resistor
- Resistor Load
Test Setup
Test Procedure

Began test with current at 0.5 A

Incremented by 0.25 A until the current reached 1.0 A

Incremented by 0.1 A until the temperature of the connector reached 75°C

Let current stabilize after each increment
Test Results

Current Capacity in Air

Ambient Temperature

- Vendor 1
- Vendor 2
- Vendor 3
## Test Results

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Current Carrying Capacity at Ambient of 70°C in Air</th>
<th>Temperature Rise above Ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor 1</td>
<td>1.4 A @70°C</td>
<td>58°C</td>
</tr>
<tr>
<td>Vendor 2</td>
<td>1.4 A @70°C</td>
<td>58°C</td>
</tr>
<tr>
<td>Vendor 3</td>
<td>1.7 A @70°C</td>
<td>55°C</td>
</tr>
</tbody>
</table>
Test Results

Met and exceeded the current capacity specified on manufacturer’s data sheets for all three vendors

Only vendor 3 passed the JPL test requirements
Next Steps

Perform test in vacuum environment to correlate data

Fabricate chassis to hold backplanes and cards