Critical Item: 4 Channel Analog Output Card

Total Quantity: 2

Find Number: 83K01152

Criticality Category: 1S

SAA No:	09IT09-001	**System/Area:**	LPS CCMS/FR1/FR2/CR3/CR4
NASA Part No:	83K01152	**PMN/ Name:**	L72-0400-14/ HIM-II
Mfg/ Part No:	Data Products New England (DNE) Technologies/ 830011520	**Drawing/ Sheet No:**	83K01102/ 8-223

Function: Provides four independent analog voltages or currents, depending on the card's configuration. These outputs are used to operate various GSE. Each analog output signal is held at its last selected state until commanded over the VMEbus to change to another state. Also, each of the output channels have status that is available on request through the VMEbus without affecting the state of the latched output.

Critical Failure Mode/Failure Mode No: Loss of card input power/09IT09-001.511.

Failure Cause: Piece part failure.

Failure Effect: Loss of card input power. The FEP will detect a power failure and stop further processing with that HIM. For the Hypergol Vapor Detection System (HIM 6397) this results in loss of capability to detect leaks during hazardous operations at Pad A and B. Possible loss of life/vehicle in the event of a hazardous condition. Detection method: System status checks will detect failure. Time to effect: Immediate.

ACCEPTANCE RATIONALE

Design:

- The HIM-II design requirements are defined in 83K01101 "Hardware Requirements for the Hardware Interface Module (HIM) HWCI P200-HW".
- The 4 Channel Analog Output Card assembly design supports reliability and maintainability requirements associated with fault detection and isolation, accessibility, tests points, and diagnostics. The mean time between failure (MTBF) per MIL-HDBK-217F is 90,000 hours.
- The card (PCB) is fabricated on a double height VME card using eight layers. The eight layers are comprised of four signal planes, three power planes, and a ground plane.
- The card assembly is designed with the constraint of ruggedization. Careful component placement, and use of a stiffeners, has been implemented to comply with this constraint.
- The card design provides status of each of it's output channels, locally or remotely via VMEbus.

- Card design provides latching type status registers to indicate error conditions, locally or remotely via VMEbus.
- Electrical isolation is provided, from chassis circuitry.
- Isolated output power is provided, using dc-to-dc converters, for each output channel.
- Optical or transformer isolation is provided for all user interface output signals.
- Channel-to-channel isolation for all analog outputs is provided, to protect the output latches from changing states.
- Input power fuses provide on-card circuit protection, as well as HIM card-to-card protection, by isolating the VMEbus power connections from the rest of the card. GSE I/O interface signals are protected by fuses, zener diodes, and resistors rated for significant power. In addition to fused protection on the output pins, a bi-directional zener diode for overvoltage/short circuit protection is provided.

Test:

- OMRSD File VI Volume I, Baseline 12/13, "LOA MMH/N204 Servicing System" requires a sensor functional test prior to each flow. OMI V3542 "Hypergol Vapor Detection System Operations Support (LPS)" provides this end-to end verification of the system (LPS/HVDS). This functional test verifies system sensors and HIM operation.
- During hypergol loading operations, personnel (in scape) are positioned on the RSS to provide visual monitor capability.

Inspection:

- LPS system integrity is continuously monitored by on-line software programs (i.e. HWMON, EMON, etc.). These programs provide health and status data to systems operators. FEPs poll the HIMs and their Input/Output Cards on a cyclic basis (1, 10, or 100 times/second) verifying the communication link with HIMs assigned. Along with status and health checks, exception monitoring provides operators notification of any change of state of HIM measurement cards.

Failure History:

- Current data on test failures, unexplained anomalies, and other failures experienced during ground processing activities can be found in the PRACA database. Since no units were installed at the time this analysis was performed no PRACA data was available.
- The GIDEP failure data interchange was researched and no failure data was found on this component in the critical failure mode.

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Operational Use:

- Correcting Action:

  For the Hypergol Vapor Detection System, loss of the HIM during loading operations would result in termination of loading. Once terminated the faulty HIM card would be replaced. Loss of HIM at any other time would have no critical effect.

- Timeframe:

  Replacing a failed component or card would take approximately 30 to 59 minutes.