

Critical Item: 8 Channel Relay Closure Card
Total Quantity: 8
Find Number: 83K01150
Criticality Category: 1S (7 cards), 2 (1 card)

JUN 10 1997

SAA No: 09IT09-001	System/Area: LPS CCMS/FR1/FR2/CR3/CR4
NASA Part No: 83K01150	PMN/ Name: L72-0400-12,-14/ HIM-II
Mfg/ Part No: Data Products New England (DNE) Technologies/ 830011500	Drawing/ Sheet No: 83K01102/ 8-278

Function: Provides GSE four independent channels of single-pole, single-throw (SPST) normally open contacts and four independent channels of single-pole double-throw (SPDT) contacts. The state of each channel is commanded over the VMEbus, each channel is electronically latched in its last selected state and remains there until commanded to change or power is lost.

Critical Failure Mode/Failure Mode No: Loss of card input power/09IT09-001.509. Unsolicited output/09IT09-001.510.

Failure Cause: Piece part failure.

Failure Effect:

System	Failure Effect	CRIT
Hypergol Vapor Detection System (HVDS), HIM-II 6397. (6 cards)	Loss of card input power. The FEP will detect a power failure and stop further processing with the HIM. For the HVDS 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.	1S
MPS LO2 Control System, HIM-II 6895. (1 card)	Unsolicited output (Close Command GLOK2711E) for the MPS LO2 Control System results in loss of GN2 purge for Orbiter/ET LOX Disconnect Carrier Plate cavity. LOX vented into an enclosed space creates a potentially flammable/explosive environment which could lead to loss of life and/or vehicle in the event of a hazardous condition. Detection method: System status checks detect the failure. Time to effect: Immediate.	1S

System	Failure Effect	JUN 10 1997 CRIT
MPS LO2 Control System, HIM-II 5986. (1 card)	<p>Unsolicited output (Close Command GLOK4191E) would interrupt heated GN2 flow to the Orbiter/ET Nose Cone where the LO2 ullage pressure transducers reside. Loss of these transducers because of icing results in loss of capability to monitor the ET pressure conditions which would result in launch delay/scrub and/or possible damage to ET instrumentation.</p> <p>Detection method: System status checks will detect failure. Time to effect: Immediate.</p>	2

ACCEPTANCE RATIONALE

Design:

- The HIM-II design requirements are defined in 83K01101 "Hardware Requirements for the Hardware Interface Module (HIM) HWCI P200-HW".
- The 8 Channel Relay Closure 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 300,000 hours.
- The 8 Channel Relay Closure Card PCB is fabricated on a double height VME card using six layers. The six layers are comprised of four signal planes, a power plane, and a ground plane.
- The card assembly is designed with the constraint of ruggedization. Careful component placement, and use of a stiffener, has been implemented to comply with this constraint.
- Card design provides each channel with auxiliary contact for health and status checking.
- Filter networks provide suppression of switching transients across relay contacts and on output signals.
- Card design provides 115 VAC protection on all GSE I/O interface lines.
- Latching type register is provided to indicate error conditions. The state of status register is accessible locally and remotely.
- The card provides on card circuit protection, and HIM card- to-card protection by isolating the VMEbus power connections through a fuse.
- Physical isolation is provided to ensure that external GSE I/O user interface signals are isolated from the internal VMEbus, so that one card's user interface problem does not cause a fault to any other cards in the system via the VMEbus backplane.

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.
- OMRSD VI, Vol I, Baseline 9/32, "MPS LO2 System LOAVAA" requires a pneumatic and solenoid valve functional checkout prior to flow. OMI G2340 "LH2/LOX Auto Component Functional Test & Hardware Checkout" provides an end-to-end verification of the system (LPS/LH2/LOX).

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.

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 card would be replaced. Loss of the HIM at any other time would have no critical effect.

For the MPS LO2 Control System:

- a. Loss of GN2 Heated purge to the ET Nose Cone Instrumentation during LOX loading would lead to either a launch delay or scrub, per Launch Commit Criteria ET-01. The corrective action for the faulty HIM A card is to replace it.
 - b. Loss of GN2 purge to the Orbiter/ET LOX Disconnect Carrier Plate cavity during LOX loading would result in a management decision to either continue with LOX loading or terminate loading operations. The corrective action for the faulty HIM A card is to replace it.
- Timeframe: Replacing a failed component or card would take approximately 30 to 59 minutes.