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Parts Stress Analysis
Dwg. No. 32-04010

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Preface

Revision 01 of this document is being prepared for submission with the CDR data package.

1 Introduction

The flight hardware for the Cosmic Ray Telescope for the Effects of Radiation (CRaTER) instrument on the Lunar Reconnaissance Orbiter (LRO) is composed of a single assembly incorporating both radiation detector and all associated power, command, data processing, and telemetry electronics. Other ICDs control electrical (32-02002), mechanical (32-02003), and thermal (32-02004) interfaces.

1.1 Scope

This document provides the results of the electronic parts stress analysis for the CRaTER instrument.

1.2 Document Structure

The heart of this document is composed of four spreadsheets that address the stress analysis for the telescope assembly, the analog board, the digital board, and the remaining miscellaneous parts.

1.3 Analysis Requirements

Per the requirements of the CRaTER Performance Assurance Implementation Plan, 32-01204, the electrical derating criteria are taken from EEE-INST-002. The applicable pages from that document are included here in Appendix E.

2 Boundary Conditions

2.1 *Bus Voltage*

The spacecraft bus operating voltage is specified in the LRO Electrical Systems Specification, 431-SPEC-000008, to range from 21 to 35 VDC at the instrument interface. There is an additional requirement to survive any voltage in the range 0 to 40 VDC (with caveats which need not concern us here).

2.2 *Instrument Temperature*

The instrument qualification temperature, as measured at the telescope wall, are given in the Thermal ICD, 431-ICD-000118, as ranging from -40 to +40C. Thermal analysis indicates that no board or chassis temperature will exceed these limits by more than 5C; we therefore assume that an analysis range of -40 to +50C will encompass all cases.

3 Methodology

In general eyes-shut, worst case conditions were assumed – *e.g.*: full bus voltage applied across a part. Only if the margin was negative under these conditions was a detailed analysis made.

Margin is defined as $(\text{derated value} - \text{applied value}) / (\text{applied value})$. Thus defined, any value of margin greater than zero meets program requirements.

**Appendix A – 32-04010.01
Telescope Board**

**Appendix B – 32-04010.02
Analog Board**

**Appendix C – 32-04010.03
Digital Board**

**Appendix D – 32-04010.05
Miscellaneous Parts**

**Appendix E – 32-04010.05
Derating Criteria from EEE-INST-002**