Rascal Interface Control Document

Saint Louis University

Rascal



Last Updated: 4/24/14

Document No: RCL-I-CMQA1

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**Revisions Summary**

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| Revision | Description | Date | Prepared by | Approved by |
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Table of Contents

[1. Interface Overview 4](#_Toc386104353)

[1.1. Coordinate Systems 4](#_Toc386104354)

[2. Primary-Secondary Spacecraft Interface Overview 5](#_Toc386104355)

# Interface Overview

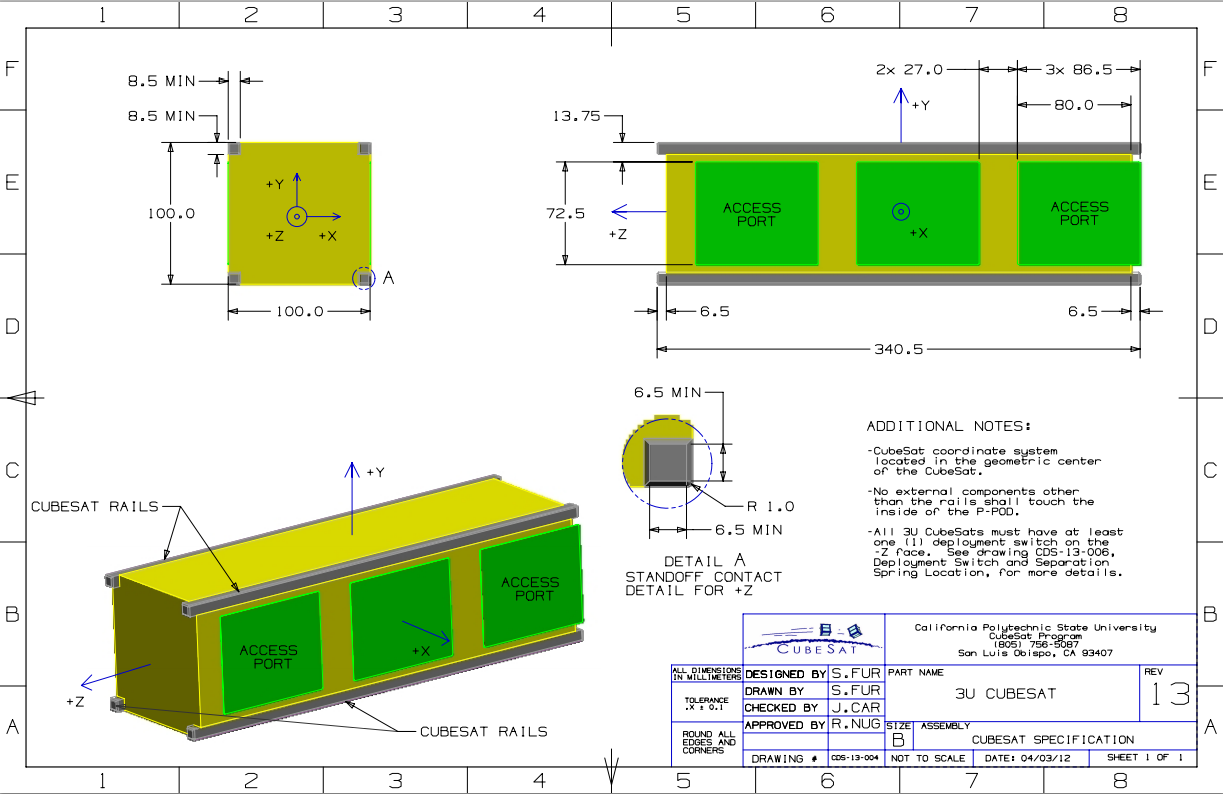
This Interface Control Document (ICD) serves to define all relevant interfaces between the Space Systems Research Lab’s (SSRL) Rascal payload (consisting of a 3U secondary spacecraft and 1.5U propulsion/image processing unit) and Boeing’s Colony-II bus. These interfaces consist of three major types:

1. **Mechanical -** structural interfaces that involve the physical connections between SSRL-Boeing components.
2. **Electrical –** digital/analog interfaces that involve data communication and power transmission to and from SSRL-Boeing components.
3. **Radio –** RF interfaces that involve data transmission between the ground and either the secondary or primary spacecraft.

Beyond these three designations, each interface can be broken down into three general categories: those that interface the secondary spacecraft with the primary spacecraft, those that interface the image processing/propulsion unit with the rest of the primary spacecraft, and those that interface both spacecraft to the ground. Each of interfaces within these categories will be defined in the sections that follow.

## Coordinate Systems

This document will make frequent use of the coordinate system definitions laid out for 3U spacecraft in the CubeSat Design Specification (CDS), Revision 13. A visualization of this coordinate system is provided in Figure 1-1. This is the coordinate system that will be used throughout this ICD, unless otherwise stated.



**Figure 1‑1 3U CubeSat Coordinate System Definition**

# Primary-Secondary Spacecraft Interfaces

There exist two main interfaces between the primary and secondary spacecraft:

* Primary-Secondary Separation Mechanism
* Secondary Spacecraft Power Inhibit

The former interface is mainly mechanical in nature, consisting of two solenoids (each housed within the secondary spacecraft) that latch onto two connection points that extend from the primary, as shown in Figure 2-1. Since the secondary spacecraft is set to be off until separation, it is required that the primary spacecraft passes power to the secondary spacecraft’s separation mechanism. The mechanism used for accomplishing this must provide a peak voltage of 5 Volts, with a current load of at least 1 Amp.

The latter interface is also mainly mechanical in nature, consisting of a simple switch that will be compressed when the secondary spacecraft is conjoined with the primary spacecraft. In this state, the switch would cut off all power between the secondary spacecraft’s batteries and the rest of the secondary spacecraft, ensuring that the secondary spacecraft has enough power to remain active over the course of its 15 day mission. When the secondary spacecraft separates from the primary spacecraft, this switch will actuate to its on state, allowing the secondary spacecraft to be powered on. A block diagram of this arrangement is provided in Figure 2-2.



# Primary-Colony-II Bus Interfaces

The main interface between the Primary Payload (PLD) and the Colony-II (COL-II) bus is a D-subminiature DB-25 connector, as shown in Figure 3-1. This interface will be used for passing power from COL-II to the PLD, as well as relaying data collected by the PLD to the communications and attitude determination and control systems (ADC) provided by COL-II and data commands and ADC sensor information from COL-II to the PLD.



**Figure 3‑1 Example DB-25 Pinout**

| Pin Number | Pin Name | Pin Name (Shorthand) | Signal Origin |
| --- | --- | --- | --- |
|  | Live Image Data Transmit | TX1 | PLD |
|  | Queried Payload Data | DAT1 | PLD |
|  | Queried COL-II Data | DAT2 | COL-II |
|  |  |  |  |
|  |  |  |  |
|  | 5V Bus | 5V | COL-II |
|  | 3.3V Bus | 3.3V | COL-II |
|  | Ground | GND | COL-II |
|  | Ground | GND | COL-II |
|  | Unregulated | UNREG | COL-II |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
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|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  | 5V Bus | 5V | COL-II |
|  | 3.3V Bus | 3.3V | COL-II |
|  | Ground | GND | COL-II |
|  |  |  |  |
|  | Unregulated | UNREG | COL-II |
|  |  |  |  |
|  |  |  |  |