

This document explains the function of the +X Panel, its schematic level design, its board level design, and its functional testing

+X Panel

Exterior PCB Panel Design

Revision: 1.0.7

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1 Introduction

This document explains how the +X Panel will fulfil the following Functions and conform to the following Requirements. This document refers to the +X Panel version 1.0.

1.1 Functions

The +X panel is responsible for the following:

- Bi-directional low gain antenna for communicating with the ground station (with deployment mechanism)
- GPS Patch Antenna
- Photodiode sensor for ADCS

1.2 Requirements

The system requirements and Comms design requirements can be viewed [on GitHub](#).

2 Detailed Description

This section references the +X Panel [schematic](#). Page numbers will be listed and may have coordinates listed (number and letter combination found around the frame).

2.1 Functional Block Diagram

The block diagram can be found on the first page of the schematic.

2.1.1 Low-Gain Antenna

The low-gain antenna is deployed via high-power resistors, thermal knife, burning through a monofilament. Once deployed, the low-gain antenna is used to transmit/receive data to/from the Ground. Transmission from this antenna consists of lower speed data transfers to the ground. Faster data rate transmissions, such as sending images, are handled by the high-gain antenna on the [-Z Panel](#).

2.1.2 GPS Patch Antenna

The GPS antenna is used to receive GPS information for the attitude determination and control subsystem ([ADCS](#)).

2.1.3 Photodiode Sensor

The +X Panel board has a photodiode which is used to sense light intensity which pertains to the position of the sun. The ADCS uses an I²C ADC to read this intensity.

2.2 Schematic

2.2.1 Photodiode

The photodiode¹ can be found on page 2 of the schematic. The photodiode is placed near the center of the board facing outward. This particular photodiode has a spectral sensitivity of $6.3nA/lx$ and the expected illuminance is on the order of $< 1Mlx$. There is a two-stage transimpedance amplifier on the output of the photodiode, which will amplify the $0 - 6mA$ input to a $0 - 2V$ output.

2.2.2 Low - Gain Antenna

The low-gain antenna (page 3, A1) is a half wave dipole: length of 357 mm , impedance of 50Ω , gain of 2.15 dB , and linear polarization. It interfaces with the communications board via a coaxial cable (page 3, A2). As the coax is unbalanced and the antenna requires a balanced signal, a balun² does this conversion. The antenna is deployed using a thermal knife (page 3, A6) consisting of two 1 W resistors. When power is applied, they burn through a monofilament

¹ CIS PN: [66-0003](#)

² [Balun](#) Document

ted to the stowed antenna, releasing the antenna. The power for the thermal knife is provided by the EPS.

While stowed, the antenna is wrapped around metal pegs (page 3, A4:A5) shorting them together. Upon deployment, the short is removed. The EPS senses this change and can determine the deployment state of the antenna.

2.2.3 GPS Patch Antenna

The GPS patch antenna (page 3, A3)³ is connected to the avionics board via a coaxial cable (page 3, A4). The antenna has an impedance of 50Ω , a center frequency of $1575\text{ MHz} \pm 3\text{ MHz}$, a bandwidth of 10 MHz for -10 dB , and right-hand circular polarization. The antenna is compatible with GPS and GALILEO signals.

2.2.4 Thermistors

The +X Panel contains seven thermistors⁴. These will be used to record temperature data at various points of the +X Panel for monitoring purposes.

2.3 Board

The board shall be double layered with 1 oz copper and ENIG finish.

2.3.1 Layout Constraints

Unless specified in the following subsections, all signals shall use the default parameters specified below. Signals in the following subsections do not include their sense signals unless specified. Trace width can be broken if a trace needs to bottleneck down to a pin, the bottleneck shall be minimized.

Trace Width:	0.2 mm
Vias:	0.3 mm, unlimited count
Separation:	0.2 mm
Length:	Unlimited

Devices with specific placement and routing considerations are noted in the schematic, see "CAD Note".

2.3.1.1 *PC - I2C_[SDA_ADCS, SCL_ADCS]*

Length:	Each node shall be length matched $\pm 1.0\text{ mm}$
Stubs:	$< 10.0\text{ mm}$

2.3.1.2 *RF Traces - LOW_GAIN_[P, N, COAX], GPS_COAX*

Track Width:	1.5 mm
Gap Width:	0.5 mm
Impedance:	50 Ω

³ [GPS Antenna](#) Document

⁴ [NTCS0603E3](#)

2.3.1.3 Power Resistors

Trace Width: 0.5 mm

3 Testing