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This document explains how the ADCS and the IHU are communication down to the byte by byte level.

ADCS Interface

Detailed Description of the ADCS and IHU Interface

Revision: 1.0.4



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# 1 Hardware Layer

The hardware interface between the ADCS and the IHU is I2C. It is a standard implementation of I2C with a clock wire and a data wire. See [Wikipedia’s I2C article](https://en.wikipedia.org/wiki/I%C2%B2C) for details on how it works.

# 2 Software Layer

The Attitude Determination Control System, located at 8b address 0xAC, is a slave board to the IHU. The IHU will request data from the ADCS to populate a telemetry packet. The ADCS data will be read at Upon receiving multiple commands, the reading done by ADCS will reflect the most recent command.

## 2.1 Location Data Request

The latitude and longitude are represented by 32b signed integers with 100µmin/LSB. For more information on latitude and longitude, please read Wikipedia’s page on the [Geographic Coordinate System.](https://en.wikipedia.org/wiki/Geographic_coordinate_system)

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x00: | 0x00: Latitude  0x01: Longitude |

## 2.2 Orientation Data Request

Roll, Pitch, and Yaw are 16b unsigned integers. Zero represents 0°, and 216 represents 2π.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x01: | 0x00: Roll  0x01: Pitch  0x02: Yaw |

## 2.3 Temperature Data Request

This command is used by the IHU when building a telemetry packet. The temperature being represented with an 8b signed integer with 1°C/LSB.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x02: | 0x00: ADCS Temp |

## 2.4 Pulse Width Modulation Data Request

The PWM is represented by a 16b unsigned integer.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x03: | 0x00: X PWM Out  0x01: Y PWM Out  0x02: Z PWM Out |

## 

## 2.5 Current Data Request

The current is represented by a 16b signed integer with 150µA/LSB.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x04: | 0x00: X Current  0x01: Y Current  0x02: Z Current |

## 2.6 Orientation Commands

These are the general rotation commands the satellite will use to orient itself when aiming towards a location on Earth, a point in space, to position solar panels, or to protect the satellite from temperature related damage.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x05 | 0x00: Roll  0x01: Pitch  0x02: Yaw |

### 2.6.1 Satellite Maneuvers for Earth

These commands pass in a latitude and a longitude as two 32b signed integers to find and maintain a fixed direction towards a location on Earth.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x06 | 0x00: Point at coordinate  0x01: Point at ground station |

### 2.6.2 Satellite Maneuvers for Space Locations

For more information about the Equatorial Coordinate System, please go to [Wikipedia’s page](https://en.wikipedia.org/wiki/Equatorial_coordinate_system) on the subject.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x07 | 0x00: Point [SIDE] at the Sun  0x01: Aim solar panels towards Sun  0x02: Point at equatorial location [RA, DEC] |

### 2.6.3 Other Satellite Maneuvers

These functions are primarily for maintaining the health of the satellite. The function “Roast the Chicken” behaves similarly to a rotisserie, allowing each side to have protection and exposure to the Sun. Drifting, on the other hand ceases work of the ADCS stabilizers, and lets it tumble freely.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x08 | 0x00: Roast the Chicken  0x01: Point [FACE] towards Sun  0x02: Point [FACE] away from sun  0x03: Drift |

# 3 Example Communication

## 3.1 Simple Data Request for ADCS temperature

IHU: [0xAC]0x0200 [ADCS write] temperature? ADCS

ADCS reads temperature data and stores value in its buffer

IHU: [0x0F] [ADCS read]

ADCS: 0xBFEC (40 \* 1°C/LSB = 40°C)

## 3.2 Simple Repeated Data Request

IHU: [0xAC]0x0301 [ADCS write] PWM of Y

IHU: [0xAC]0x0200 [ADCS write] temperature? ADCS

ADCS reads temperature data and stores value in its buffer

IHU: [0x0F] [ADCS read]

ADCS: 0xBFEC (40 \* 1°C/LSB = 40°C)