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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: 1.0.0



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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. Data requests from the IHU to the ADCS as for telemetry packets.

## 2.1 Location Data Request

The latitude and longitude are represented by 32b unsigned double. Latitude is measured South (-90°) to North (90°), and longitude is East (-180°) to West (180°), and each degree holing 60 minutes, and each minute holding 60 seconds. Given this, Latitude needs an integer large that 648000 (90° 60’ 60”), longitude needing 1296000(180, to represent all seconds in a given direction.

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

### 2.1.1 Latitude Table

|  |  |  |
| --- | --- | --- |
| The South Pole | -90.0000 | -90° South |
| The Equator | 0.0000 | Equator |
| The North Pole | 90.0000 | 90° North |

### 2.1.2 Longitude Table

|  |  |  |
| --- | --- | --- |
| Antemeridian | -180.0000 | -180 East |
| Prime Meridian | 0.0000 | 0 |
| Antemeridian | 180.0000 | 180 West |

## 2.2 Orientation Data Request

Roll, Pitch, and Yaw are 16b unsigned integers. Zero represents 0°, and 64800 represents 360°.

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

## 2.2 Temperature Data Request

This command is used by the IHU when building a telemetry packet. The temperature being represented with an 8b unsigned integer with 1°C/LSB. the PWM being represented by 16b from 0-255 and the current represented by a 16b value with 150µA/LSB.

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

## 2.3 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 |

## 2.4 Current Data Request

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

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

## 2.5 Orientation Command

The orientation command is send one of 4 arguments, or all at once:

1. Roll Orientation
2. Pitch Orientation
3. Yaw Orientation
4. Object ID to orient against

These are intended to serve one-off functions, and not govern how the satellite will point the solar panels towards the sun. An example use case is turning the satellite towards Earth for a picture, then surrendering control of the orientation to whichever system governs solar panel orientation.

At Roll = 0, Pitch = 0, Yaw = 0, and object ID 0 representing Earth, the satellite will point its camera towards earth with panels orthogonal to the plane of motion, this represents the standard position. A satellite originally at standard, when modified with a yaw of 180°, will spin backwards, facing directly away from Earth. All other axis will behave similarly.

|  |  |  |
| --- | --- | --- |
| Index | 0x00 | 0x01 |
| Function | 0x05 | 0x00 Roll against ID  0x01: Pitch against ID  0x02: Yaw against ID  0x03: Set ID |

# 3 Example Cases

## 3.1 Orient away from Earth

IHU: [0x0503] with an ID of 0

Sets orient ID to Earth

IHU: [0x0502] with a an argument of 180°

ADCS: Begins rotation of XY plane