

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

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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](#) 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 100 μ m/LSB. For more information on latitude and longitude, please read Wikipedia's page on the [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 2^{16} 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 150 μ A/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](#) 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 ($40 * 1^{\circ}\text{C}/\text{LSB} = 40^{\circ}\text{C}$)

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 ($40 * 1^{\circ}\text{C}/\text{LSB} = 40^{\circ}\text{C}$)