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This document explains how the IFJR and the IHU are communicating down to the byte by byte level.

IFJR Interface

Detailed Description of the IFJR and IHU Interface

Revision: 1.0.4



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# 1 Hardware Layer

The hardware interface between the IFJR 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 In-Flight JTAG Reprogramming, located at address 0x1E, is a slave board to the IHU. The IFJR oversees the updating of select processors.

## 2.1 Temperature Data Request

The IFJR responds with an signed integer with .

### 2.1.1 IHU to IFJR

The first byte represents the command ID, 0x00.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Byte Offset | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 | 0x05 | 0x06 | 0x07 |
| 0x00 | 0x00 |  |  |  |  |  |  |  |

### 2.1.2 IFJR to IHU

The IFJR responds with an array of two signed integers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Byte Offset | 0x00 | 0x01 | 0x02 | 0x03 |
| 0x00 | ADCS (µController)  Temperature | SD Card Temperature |  |  |

## 2.2 Storage Capacity Data Request

This command is used to determine the total capacity used for IFJR’s SD card. The bytes used is represented by a unsigned integer with .

### 2.2.1 IHU to IFJR

The first byte represents the command ID, 0x01.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Byte Offset | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 | 0x05 | 0x06 | 0x07 |
| 0x00 | 0x01 |  |  |  |  |  |  |  |

### 2.2.2 IFJR to IHU

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Byte Offset | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 | 0x05 | 0x06 | 0x07 |
| 0x00 | Bytes Used | | | | | | | |

## 2.3 Reprogram Select Processor

This command assumes the processor binary has already been sent and exists in the IFJR’s SD card.

### 2.3.1 IHU to IFJR

The first byte represents the command ID, 0x02. The second byte, represented by an unsigned integer, is the target subsystem which will be reprogrammed. The remaining bytes are all unsigned integers representing the major, minor, and patch version associated with the binary. This is in alignment with the communication protocol[[1]](#footnote-1) reprograming definition, Section 3.2.2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Byte Offset | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 |
| 0x00 | 0x02 | 0x00: ADCS  0x01: IFJR  0x02: IHU  0x03: PMIC  0x04: Comms  0x05: Payload 1  0x06: Payload 2  0x07: Payload 3 | Major | Minor | Patch |

### 2.3.2 IFJR to IHU

The ADCS replies with an error code defined in Code SOP 6.4.1[[2]](#footnote-2).

## 2.4 Send Binary to IFJR

This command will send a fully packaged binary from the IHU to IFJR.

### 2.4.1 IHU to IFJR

The first byte is the command ID, 0x03. The next parameter is a unsigned integer representing the size with . The following bytes contain the data of the binary.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Byte Offset | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 | 0x05 | 0x06 | 0x07 |
| 0x00 | 0x03 | Size of Binary | | | | Data… | Data… | Data…. |

### 2.4.2 IFJR to IHU

The IFJR replies with an error code defined in Code SOP 6.4.1[[3]](#footnote-3).

# 3 Example Communication

## 3.1 Data Request for Location

IHU: [0x1E] 0x00 [IFJR write] temperature request  
 IFJR reads temperature and stores data in its buffer  
IHU: [0x1F] [IFJR read]  
IFJR: 0x5A

## 3.2 Repeated Data Request

IHU: [0x1E] 0x01 [IFJR write] storage capacity used request  
 IFJR reads capacity and stores data in its buffer  
IHU: [0x1E] 0x00 [IFJR write] IFJR Processor Temperature Request  
 IFJR collects the processors temperature  
IHU: [0x1F] [IFJR read]  
IFJR: 0x5A

## 3.3 Reprogramming Command

IHU: [0x1E] 0x0200010203 [IFJR write] begin process of reprogramming  
 IFJR checks with ADCS and begins flashing ADCS binary v1.2.3  
IHU: [0x1F] [IFJR read]  
IFJR: 0x00 Success

1. <https://github.com/CougsInSpace/CougSat1-Software/blob/master/CougSat1-IHU/docs/CommunicationProtocol.pdf> [↑](#footnote-ref-1)
2. <https://github.com/CougsInSpace/Resources/blob/master/StandardOperatingProcedures/Code.pdf> [↑](#footnote-ref-2)
3. ibid [↑](#footnote-ref-3)