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AERTS, BRANDON B.J.J.

Fontys hogeschool ICT

Rachelsmolen 1, R10

COmmunicatie Protocol Drone Project

Explanation and assignment of protocol for drone communication

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# Declaration of Communication Protocol

Below is the declaration of all the possible messages that can be exchanged between the Drone, Computer and Controller.

The declaration is built up of a couple parts, the first column is Message Name, this is just the type of message that is being sent to the drone, here Header1 shows the least significant bits which include data about the type of command, Header 2 shows partly the 2 most significant bits for declaring the command type and partly a scalar for the size of data sent in the data part of the command. Third is the Metadata, this shows how large the Data is, this number can be multiplied by 2 depending on the value of the scalar but is just a binary representation of the size of the data in Bytes. Next up is the data, these are just the parameters sent with the command. (Langenhuijzen, 2025) Lastly is an example of the code, this is represented in binary and shows what data is being sent. I will be using a couple characters to represent different bits:

|  |  |
| --- | --- |
| A | This bit shows where the command is coming from, when a message’s origin is the computer, this is 0 and when the message’s origin is the controller it’s a 1. Every message starts with 1 of these bits and in the case of a bitflip, the majority is chosen as origin if necessary. |
| c | These are the parity bits we use for hamming code; every byte will have 3 of these to check if the byte has not had any interference. (Sanderson, Hamming codes and error correction, 2020) |
| d | These are data bits, they change depending on what data is being sent in the data table, when you put all the d bits together, they should form an int or float depending on what it says in the DataType table |

Field just shows what each byte / set of bytes represents. This could be multiple things if a single byte is split up between functions like in the case with Header2

The DataType field shows what datatype will be reserved for this operation, keep in mind that the amount of actual data that can be sent over these bits is halved to make room for the A bit and parity bits. A UINT8 in the table will contain 4 bits of data, 3 bits of hamming and a single bit for the origin.

Lastly the description, the description just shows what is meant by the previous tables, this is often a binary or hexadecimal representation of what is being sent between the devices.

## All messages

### Control message

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x00: Ack |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b01 / Scalar |
| Metadata | Data Length | UINT8 | 0 Bytes |
| Example | Acc0c000 Acc0c110 Acc0c000 | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x00: Nack |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b10 / Scalar |
| Metadata | Data Length | UINT8 | 0 Bytes |
| Example | Acc0c000 Acc1c010 Acc0c000 | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x00: Status |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b11 / Scalar |
| Metadata | Data Length | UINT8 | 2 Bytes |
| Data | Argument 0 | UINT8 | Error Code (LSB) |
| Argument 0 | UINT8 | Error Code (MSB) |
| Example | Acc0c000 Acc1c110 Acc0c010 Accdcddd Accdcddd | | |

### Toggle message

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x01: Start |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b01 / Scalar |
| Metadata | Data Length | UINT8 | 0 Bytes |
| Example | Acc0c001 Acc0c110 Acc0c000 | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x01: Stop |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b10 / Scalar |
| Metadata | Data Length | UINT8 | 0 Bytes |
| Example | Acc0c001 Acc1c010 Acc0c000 | | |

### Movement message

(Les 2: Pitch, Yaw en Roll, n.d.)

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x02: AUp |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b00 / Scalar |
| Metadata | Data Length | UINT8 | 2 Bytes |
| Data | Argument 0 | INT8 | Acceleration (LSB) |
| Argument 0 | INT8 | Acceleration (MSB) |
| Example | Acc0c010 Acc0c010 Acc0c010 Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x02: AYaw |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b01 / Scalar |
| Metadata | Data Length | UINT8 | 2 Bytes |
| Data | Argument 0 | INT8 | Acceleration (LSB) |
| Argument 0 | INT8 | Acceleration (MSB) |
| Example | Acc0c010 Acc1c010 Acc0c010 Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x02: ARoll |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b10 / Scalar |
| Metadata | Data Length | UINT8 | 2 Bytes |
| Data | Argument 0 | INT8 | Acceleration (LSB) |
| Argument 0 | INT8 | Acceleration (MSB) |
| Example | Acc0c010 Acc1c010 Acc0c010 Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x02: AThrottle |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b11 / Scalar |
| Metadata | Data Length | UINT8 | 2 Bytes |
| Data | Argument 0 | INT8 | Acceleration (LSB) |
| Argument 0 | INT8 | Acceleration (MSB) |
| Example | Acc0c010 Acc1c110 Acc0c010 Accdcddd Accdcddd | | |

### Live Telemetry message

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x03: Speed |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b00 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | Relative Speed (LSB) |
| Argument 0 | FL32 | Relative Speed (MSB) |
| Argument 1 | FL32 | Velocity (LSB) |
| Argument 1 | FL32 | Velocity (MSB) |
| Example | Acc0c011 Acc0c011 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x03: Acceleration\_Bar |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b01 / Scalar |
| Metadata | Data Length | UINT8 | 12 Bytes |
| Data | Argument 0 | UINT16 | Acceleration (LSB) |
| Argument 0 | UINT16 | Acceleration (MSB) |
| Argument 1 | FL32 | Pressure (LSB) |
| Argument 1 | FL32 | Pressure (MSB) |
| Example | Acc0c011 Acc0c110 Acc1c100 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

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| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x03: RPM |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b10 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | UINT16 | Rotor1 (LSB) |
| Argument 0 | UINT16 | Rotor1 (MSB) |
| Argument 1 | UINT16 | Rotor2 (LSB) |
| Argument 1 | UINT16 | Rotor2 (MSB) |
| Argument 2 | UINT16 | Rotor3 (LSB) |
| Argument 2 | UINT16 | Rotor3 (MSB) |
| Argument 3 | UINT16 | Rotor4 (LSB) |
| Argument 3 | UINT16 | Rotor4 (MSB) |
| Example | Acc0c011 Acc1c011 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x03: Rotor COM |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b11 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | UINT16 | Rotor1 (LSB) |
| Argument 0 | UINT16 | Rotor1 (MSB) |
| Argument 1 | UINT16 | Rotor2 (LSB) |
| Argument 1 | UINT16 | Rotor2 (MSB) |
| Argument 2 | UINT16 | Rotor3 (LSB) |
| Argument 2 | UINT16 | Rotor3 (MSB) |
| Argument 3 | UINT16 | Rotor4 (LSB) |
| Argument 3 | UINT16 | Rotor4 (MSB) |
| Example | Acc0c011 Acc1c111 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x04: Error |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b00 / Scalar |
| Metadata | Data Length | UINT8 | 2 Bytes |
| Data | Argument 0 | UINT8 | Error (LSB) |
| Argument 0 | UINT8 | Error (MSB) |
| Example | Acc0c100 Acc0c010 Acc0c010 Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x04: Power Status |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b01 / Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 1 | FL16 | Voltage (LSB) |
| Argument 1 | FL16 | Voltage (MSB) |
| Argument 2 | FL16 | Current (LSB) |
| Argument 2 | FL16 | Current (MSB) |
| Example | Acc0c100 Acc0c110 Acc0c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x04: Pitch Roll |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b10 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | Pitch (LSB) |
| Argument 0 | FL32 | Pitch (MSB) |
| Argument 1 | FL32 | Roll (LSB) |
| Argument 1 | FL32 | Roll (MSB) |
| Example | Acc0c100 Acc1c010 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

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| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x04: Yaw |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b11 / Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | Yaw (LSB) |
| Argument 0 | FL32 | Yaw (MSB) |
| Example | Acc0c100 Acc1c110 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

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| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x05: Soc\_Load |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b00 / Scalar |
| Metadata | Data Length | UINT8 | 4 Bytes |
| Data | Argument 0 | UINT8 | SOC (LSB) |
| Argument 0 | UINT8 | SOC (MSB) |
| Argument 1 | UINT8 | Load (LSB) |
| Argument 1 | UINT8 | Load (MSB) |
| Example | Acc0c101 Acc0c010 Acc0c100 Accdcddd Accdcddd Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x06: EMF1&2 |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b00 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | EMF1 (LSB) |
| Argument 0 | FL32 | EMF1 (MSB) |
| Argument 1 | FL32 | EMF2 (LSB) |
| Argument 1 | FL32 | EMF2 (MSB) |
| Example | Acc0c110 Acc0c010 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

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| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x06: EMF3&4 |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b01 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | EMF3 (LSB) |
| Argument 0 | FL32 | EMF3 (MSB) |
| Argument 1 | FL32 | EMF4 (LSB) |
| Argument 1 | FL32 | EMF4 (MSB) |
| Example | Acc0c110 Acc0c110 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

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| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x06: IMotor1&2 |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b10 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | IMotor1 (LSB) |
| Argument 0 | FL32 | IMotor1 (MSB) |
| Argument 1 | FL32 | IMotor2 (LSB) |
| Argument 1 | FL32 | IMotor2 (MSB) |
| Example | Acc0c110 Acc1c010 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Message Name | Field | DataType | Description |
| Header1 | Command (LSB) | UINT8 | 0x06: IMotor1&2 |
| Header2 | Command/Scalar (MSB) | UINT8 | 0b11 / 2x Scalar |
| Metadata | Data Length | UINT8 | 8 Bytes |
| Data | Argument 0 | FL32 | IMotor3 (LSB) |
| Argument 0 | FL32 | IMotor3 (MSB) |
| Argument 1 | FL32 | IMotor4 (LSB) |
| Argument 1 | FL32 | IMotor4 (MSB) |
| Example | Acc0c110 Acc1c110 Acc1c000 Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd Accdcddd | | |

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