Software Interface Control Document

# Preface:

This document outlines the internal software interfaces within the Strelka PCB environment. These interfaces are separated into two sections being the communication between the host processor and power distribution processor and the communication between the host processor and the ground station over a 915MHz RF link.

# Actuator control interface:

This interface consists of a SPI communications bus between the host board and the power distribution board. Communications will be initiated by the master when the chip select (CS) pin is pulled low. The master either send commands or request data. Due to hardware limitations, SPI packets must be of a fixed length. The communication bus packets will consist of the following fields:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Packet field | Identifier | Payload | Padding | CRC32 |
| Data type | uint8\_t | uint8\_t | uint8\_t | uint32\_t |
| Length (bytes) | 1 | variable | Variable | 4 |
| Description | Signify the packet type | Fields containing fixed length payloads | Padding to ensure packet size is equal to PACKET\_SIZE | 32-bit CRC checksum |

## Packet types:

**Set servo positions:**

Sets the positions of the 4 servos.

Sent from master:

Length: 21 bytes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Set servo positions** | Identifier | Servo 1 position | Servo 2 position | Servo 3 position | Servo 4 position | Padding | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t | uint32\_t | uint32\_t | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 | 4 | 4 | 0 | 4 |
| Value | 0x44 | - | - | - | - | 0 | - |

Received from slave:

|  |  |  |  |
| --- | --- | --- | --- |
| **Set servo positions response** | Identifier | Actuator control state TypeDef | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 1 | 4 |
| Value | 0x44 | - | - |

**Set DC motor positions:**

Sets the angular positions of the two DC motors.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Set DC motor positions** | Identifier | Motor 1 position | Motor 2 position | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 | 4 |
| Value | 0x45 | - | - | - |

**Set DC motor rate:**

Sets the angular rate of the two DC motors.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Set DC motor rate** | Identifier | Motor 1 position | Motor 2 position | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 | 4 |
| Value | 0x46 | - | - | - |

**Set DC motor gains:**

Sets the control gains used to control the DC motors.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Set DC motor gains** | Identifier | Motor 1 Kp | Motor 1 Ki | Motor 1 Kd | Motor 2 Kp | Motor 2 Ki | Motor 2 Kd | CRC32 |
| Data type | uint8\_t | uint16\_t | uint16\_t | uint16\_t | uint16\_t | uint16\_t | uint16\_t | uint32\_t |
| Length (bytes) | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 4 |
| Value | 0x47 | - | - | - | - | - | - | - |

**Request DC motor positions:**

Sent from master:

|  |  |  |
| --- | --- | --- |
| **Request stepper motor rate** | Identifier | CRC32 |
| Data type | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 |
| Value | 0x48 | - |

Received from slave:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Request DC motor positions** | Identifier | Motor 1 position | Motor 2 position | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 | 4 |
| Value | 0x49 | - | - | - |

**Request DC motor rates:**

Sent from master:

|  |  |  |
| --- | --- | --- |
| **Request stepper motor rate** | Identifier | CRC32 |
| Data type | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 |
| Value | 0x4A | - |

Received from slave:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Request DC motor positions** | Identifier | Motor 1 rate | Motor 2 rate | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 | 4 |
| Value | 0x4B | - | - | - |

**Set stepper motor position:**

Sets the position of the single stepper motor.

|  |  |  |  |
| --- | --- | --- | --- |
| **Set stepper motor position** | Identifier | Motor 1 position | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 |
| Value | 0x4C | - | - |

**Set stepper motor rate:**

Sets the angular rate of the stepper motor.

|  |  |  |  |
| --- | --- | --- | --- |
| **Set stepper motor rate** | Identifier | Motor 1 position | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 |
| Value | 0x4D | - | - |

**Request stepper motor rate:**

Requests the angular rate of the stepper motor.

Sent from master:

|  |  |  |
| --- | --- | --- |
| **Request stepper motor rate** | Identifier | CRC32 |
| Data type | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 |
| Value | 0x4E | - |

Received from slave:

|  |  |  |  |
| --- | --- | --- | --- |
| **Set stepper motor rate** | Identifier | Motor 1 position | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 |
| Value | 0x4E | - | - |

# Ground station control interface:

This interface consists of a RF link between the Strelka PCB (slave) and the ground station (master). The radio communication is at 915MHz using LoRa modulation. Communications are half duplex and always initiated by the ground station. Data will be transmitted back from the Strelka PCB only after a request is made by the ground station.

## Packet types:

**Test gimbal:**

Sent from master:

|  |  |  |
| --- | --- | --- |
| **Test gimbal** | Identifier | CRC32 |
| Data type | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 |
| Value | 0x01 | - |

Received from slave:

|  |  |  |  |
| --- | --- | --- | --- |
| **Test gimbal** | Identifier | Result | CRC32 |
| Data type | uint8\_t | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 1 | 4 |
| Value | 0x01 | 0 or 1 | - |

**Get continuity:**

Sent from master:

|  |  |  |
| --- | --- | --- |
| **Get continuity** | Identifier | CRC32 |
| Data type | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 |
| Value | 0x02 | - |

Received from slave:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Get continuity** | Identifier | Main continuity | Drogue continuity | CRC32 |
| Data type | uint8\_t | uint8\_t | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 1 | 1 | 4 |
| Value | 0x01 | 0 or 1 | 0 or 1 | - |

**Get battery voltage:**

Sent from master:

|  |  |  |
| --- | --- | --- |
| **Get battery voltage** | Identifier | CRC32 |
| Data type | uint8\_t | uint32\_t |
| Length (bytes) | 1 | 4 |
| Value | 0x01 | - |

Received from slave:

|  |  |  |  |
| --- | --- | --- | --- |
| **Get battery voltage** | Identifier | Battery voltage | CRC32 |
| Data type | uint8\_t | uint32\_t | uint32\_t |
| Length (bytes) | 1 | 4 | 4 |
| Value | 0x01 | 0 or 1 | - |