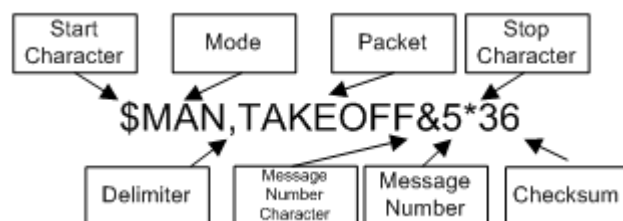


ICARUS Communications Protocol Guide

Packet Structures

All Packets will be started with a "\$", their 3 character type code, any parameters, a "&", the message number, and will be terminated by a "*", and be delimited by a ",". Immediately following the "*" character will be the complete packet size, starting with the "\$" character and ending with the "*" character.



Checksum's will be an unsigned and 2 hexadecimal digits long and will rollover after reaching 0xFF. [Checksum Calculator](#)

Sequence Numbers will be unsigned and 4 decimal digits long and will rollover after reaching 9999.

Values incoded in the Packet Payload will be of varying datatypes and precisions with the following definitions:

PWM values range between 0 and 255.

GPS values (latitude and longitude) will be 6 decimal digits long (with an optional sign byte) and represent the value in decimal degrees multiplied by 10000 (to avoid any decimal point).

INTEGERS will be unsigned and 4 decimal digits long and will rollover after reaching 9999.

DECIMAL will be 4 decimal digits (with an optional sign byte) and represent the value scaled by the number that is defined with that Data Type (to avoid any decimal point).

Priority defines how much bandwidth will be required for a packet. The bandwidth requirement is given by the following formula:

$$\text{Bandwidth} = \text{Packet_Size} * 10^{(\text{Priority}-1)}$$

Orange packets are for example only, the document [ICARUS Protocol Specifications](#) should be used for further reference.

Example:

\$WPT,ADD,1,883473,983272&27*30

->Tells Vehicle to Set waypoint 1 to Latitude 88.347 and Longitude to 98.327

Packet Types

General Packets

CAL: Calibration

\$CAL,<Message>|,<Value>*

-Message:

"INFO": Set Value on Vehicle.

“NEXT”: Go to next step in Calibration Procedure, where Value is the step.

“DONE”: When Calibration is complete.

CAM: Camera (Future Implementation)

CON: Control

\$CON,<Message>|,<Value>*

-Message:

“BOOT”: Selects Boot mode, where Value is the specific Boot Mode.

“RESET”: Reboot Vehicle.

\$MAN,RESET&345*12

"OFF": Kills Vehicle.

\$MAN,OFF&345*12

"TAKEOFF": Vehicle enters TAKEOFF Mode.

\$MAN,TAKEOFF&345*12

"HOVER": Vehicle enters HOVER Mode.

\$MAN,HOVER&345*12

"LAND": Vehicle enters LAND Mode.

\$MAN,LAND&345*12

"MANUAL": Vehicle enters Manual Control Mode.

"AUTO": Vehicle enters Autonomous Mode.

"PACKET": Receiver is missing a data packet, where Value is the sequence number that is missing.

\$CON,PACKET,0000&345*12

INF: Informational Message

\$INF, <Message>*

-Message: Any information to be passed between Interface and Vehicle.

ERR: Error Message

\$ERR,<Error #>*

-Error Number is Error Code as described in Documentation.

\$ERROR,12345&345*12

MAN: Manual Control :

\$MAN,|<Device>,<Value 1>|<Value 2>...<Value n>*

-Device:

“THROTTLE”, where Value 1 is a PWM value from 0-255.

“ROLL”, where Value 1 is a PWM value from 0-255.

“YAW”, where Value 1 is a PWM value from 0-255.

“PITCH”, where Value 1 is a PWM value from 0-255.

“DRIVE”, where Value 1 is a PWM value from 0-255.

“STEER”, where Value 1 is a PWM value from 0-255.

"SONIC", where Value 1 is a PWM value from 0-255.

-With Device field omitted:

Value 1 - 4 are PWM values from 0-255:

Value 1: Pitch

Value 2: Roll

Value 3: Yaw

Value 4: Throttle

*\$MAN,255,255,255,255&345*12*

MOTOR: Motor Control

*\$MOTOR,<Value 1>|<Value 2>...<Value n>**

Value 1 - 4 is a PWM value from 0-255. *This packet controls each motor specifically.

NET: Network Messages

*\$NET,<Message>|,<Value>**

-Message:

"ACK", Message is received and acknowledged.

*\$NET,NCK&345*12*

"NCK", Message was not received correctly and is not acknowledged.

*\$NET,ACK&345*12*

"TEST": Performs Network Test, Vehicle Should respond back with: "\$NET,ACK*"

*\$NET,TEST&345*12*

"ID": Network ID, where Value is the Channel between 0x00 and 0xFF.

*\$NET,ID,255&345*12*

"BAUD": Network Baud Rate, where Value is the Baud Rate.

*\$NET,BAUD,1152&345*12*

SEN: Sensor Data

*\$SEN,<Sensor Type>,<Value 1>,<Value 2>, ...<Value n>**

-Sensor Types:

"ACC": Value 1 - x axis, Value 2 - y axis, Value 3 - z axis, in meters/second².

*\$SEN,ACC,0000,1111,2222&345*12*

"CMP": Value 1 - heading, in degrees.

*\$SEN,CMP,000&345*12*

"ULT": Value n - Ultrasonic Distance for Sensor n, in centimeters.

*\$SEN,ULT,000,111,222,333,444&345*12*

"GYR": Value 1 - yaw, Value 2 - roll, Value 3 - pitch, in degrees/second.

*\$SEN,GYR,0000,1111,2222&345*12*

"ENC": Value n - Motor Speed for Encoder n, in revolutions per minute.

*\$SEN,ENC,0000,1111,2222,3333&345*12*

"ALT": Value 1: Altitude in meters

*\$SEN,ALT,123&345*12*

"INU": Value 1 - x-axis displacement, Value 2 - y-axis displacement, Value 3 - z-axis displacement, in meters. Value 4 - Pitch Angle, Value 5 - Roll Angle, Value 6 - Yaw Angle, in Degrees.

*\$SEN,INU,0000,1111,2222,3333,4444,5555&345*12*

"GPS": Value 1 - Time, Value 2 - Latitude, Value 3 - Longitude, Value 4 - Altitude.

*\$SEN,GPS,000000,111111,222222,333333&345*12*

STA: Status

*\$STA,<Message>|,<Value>**

-Message:

"POWMV": Power level, where Value is the Main Supply Voltage

\$STA,POWMV,1100&345*12

“POW5V”: Power level, where Value is the 5V battery voltage.

\$STA,POW5V,0500&345*12

”POWMC”: Power level, where Value is the Supply current.

\$STA,POWMC,1300&345*12

“DIST”: Current distance to target, where Value is distance in feet.

\$STA,DIST,1000&345*12

“BEAR”: Current bearing to target, where Value is bearing in degrees.

\$STA,BEAR,180&345*12

"ALT": Current Altitude in meters.

\$STA,ALT,1000&345*12

“VID”: Vehicle ID, where Value is the Vehicle ID.

\$STA,VID,1000&345*12

"GPSNOFIX": GPS Location is not available.

\$STA,GPSNOFIX&345*12

"GPSFIX": GPS Location is available.

\$STA,GPSNOFIX&345*12

"INUNOFIX": INU Data is not available.

\$STA,INUNOFIX&345*12

"INUFIX": INU Data is available.

\$STA,INUNOFIX&345*12

"COND": Condition of Vehicle, Where Value is a String

\$STA,COND,NORMAL&345*12

WPT: Waypoint

\$WPT,<Control>|<Value 1> ... <Value n>*

"ADD": Adds the next waypoint, with the following parameters:

Value 1 - Waypoint Number.

Value 2 - Latitude

Value 3 - Longitude

Value 4 - Altitude, referenced to Sea Level. Value 4 is optional.

\$WPT,ADD,0000,-8733234,-3823432,1244&345*12

“RESET”: Resets waypoint navigation.

\$WPT,RESET&345*12

“LOOP”: Loop between Waypoints, as specified in Values 1 ... Value n.

\$WPT,LOOP,0000&345*12

“GO”: With No other information, Start waypoint navigation.

\$WPT,GO&345*12

"GO", <x>: Proceed immediately from current location to x waypoint.

\$WPT,GO,0000&345*12

“PAUSE”: Pause waypoint navigation

\$WPT,PAUSE&345*12

"STOP": Stops waypoint navigation..

\$WPT,STOP&345*12

Minimized Packets

The purpose of these packets is to minimize the overhead required.

Motor Control

Packet will be built like so:

Each motor, M1, M2, M3, M4 gets a value from 0x00 - 0xFE (0 - 254).

Packet will have a start byte of 0xFF. So a sample packet would be:

0xFF01020304

Test Plan Packets

The purpose of these packets is for different Tests that must be performed to measure sensor and system characteristics.

Phase 1 Test 2

\$RSSI,latitude,longitude,rssi_value*

Phase 1 Test 5

\$RSSI,latitude,longitude,rssi_value,seq_number*

GPS Packets

GPS Packets will follow the same conventions, following the NMEA 0183 Standard.

RMC: Recommended Minimum Specific GPS Data, gives Latitude/longitude, bearing, ground speed, etc.

GSV: Gives number of Satellite Views, etc.