



56-0129 Rev A

CG-5100
IMU
Interface Control Document

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 8/25/08
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Revision	Description	Date
0	Initial revision	
1	Sense of rotation and acceleration changed. Unit name of CG-5100 used in place of COTS-IMU.	
2	Correct maximum odometer pulse count	
A	Release to Rev A	8-15-08

1 General

This document specifies the messages and data items that are transmitted by the CG-5100 IMU.

2 Data Communication

2.1 *Interface Connector*

The controlling document for this connector is KVH document 99-0237.

2.2 *Data Format*

IMU data is transmitted over a full duplex, LVTTTL interface at 115,200 bps. Each character contains 11 bits: one start bit, 8 data bits (lsb first), and two stop bits. An idle line is always MARKING. A start bit is a SPACE and the stop bit is a MARK. All multi-byte fields shall be sent sequentially with the most significant byte first and the least significant byte last.

2.3 *Message Format*

All messages contain a header, data, and a checksum . Each section is described below.

2.3.1 Header - The value of this field is always 0xFE81FF55, and 0xFE shall be transmitted first. This value shall not occur anywhere else in the message.

2.3.2 The data portion of the message is described in section 4.

2.3.3 The checksum shall be computed as follows. Treat each byte in the data portion of the message as an unsigned, eight-bit integer. Initialize the accumulator to 0 before accumulating the message bytes. The checksum for transmission shall be the least significant two bytes of the accumulator.

3 Data Types

3.1 Floating Point

All data transmitted from the IMU shall be in IEEE-754, single precision floating point (SPFP) format.

3.1.1 NaN

Floating point NaN is defined by IEEE-754 as any floating point number whose exponent is set to 255. Depending on the particular implementation of the IEEE-754 standard, the floating-point representation of NaN may possibly take on a value that could cause the header value to be seen in the message stream. To prevent a header value from occurring in the data portion of the message, the IMU software shall first compare the floating-point data with the following two values.

- 0xFE81FF55
- 0xFF55zzzz where z is any value.

If either pattern is found in a floating-point number, the IMU software shall change the value of NaN to 0xFFFFFFFF before transmitting the data.

3.2 Integer

3.2.1 UINT8

UINT8 is an eight-bit unsigned number ranging from 0 through 255.

3.3 Status

3.3.1 DISC

Discrete values are used to indicate status. Valid status is indicated by logic 1, and invalid status is indicated by logic 0.

4 Message Descriptions

The IMU shall transmit the message defined below.

4.1 Current Measurement

4.1.1 Message Length

30 bytes

4.1.2 Repeat Rate

100 per second \pm 500 ppm

4.1.3 Description

This message contains the gyro, accelerometer, and odometer data.

4.1.4 Structure

Table 1 – Current Measurement Data Block

Datum	Byte Number(s)	Data Type	Output Range	Notes
X angle	1,2,3,4	SPFP	± 0.66 Radians	Assumes 100 Hz TOV
Y angle	5,6,7,8	SPFP	± 0.66 Radians	Assumes 100 Hz TOV
Z angle	9,10,11,12	SPFP	± 0.66 Radians	Assumes 100 Hz TOV
X velocity	13,14,15, 16	SPFP	± 1 Meter/Second	Assumes 100 Hz TOV
Y velocity	17,18,19,20	SPFP	± 1 Meter/Second	Assumes 100 Hz TOV
Z velocity	21,22,23,24	SPFP	± 1 Meter/Second	Assumes 100 Hz TOV
Odometer Pulses	25,26,27,28	SPFP	± 450 pulses	Interface Hardware limited
Status	29	DISC	1 = valid, 0 = invalid	See table 3
Sequence Number	30	UINT8	0-127	Increments for each message and wraps after 127 to prevent the sequence number and the checksum that follows from looking like a header.

Table 2 – Status Definition

Datum	Bit Number	Notes
Gyro X Status	0 (lsb)	
Gyro Y Status	1	
Gyro Z Status	2	
Unused	3	Set to 0
Accelerometer X Status	4	
Accelerometer Y Status	5	
Accelerometer Z Status	6	
Unused	7	Set to 0

Notes:

1. Gyro status changes at about 18.75 Hz, so each gyro status event will be reported about 5 times. Accelerometer status changes at 100 Hz.

5 Time of Validity (TOV) Indicator

The CG-5100 shall output a 100 Hz, Logic Level waveform to indicate precise timing of the measurement data. The data output after the rising edge of the 3.3 Vdc TTL logic

signal shall correspond to the most recent 2000 Hz filter update that occurred due to the TOV active edge.

The start bit of the output data header shall be transmitted within 500 μ sec of the TOV active edge.

6 Sensor Orientation

The IMU sensors shall be configured such that Y is forward, Z is up, and X is to the right hand side. Counter clockwise rotation about an axis when looking from the + to the – of the axis shall be reported as positive. Acceleration along an axis shall be reported such that gravity is reported as +1 G when the +Z is pointing up.