Technical Note

Inertia-Link®
3DM-GX2®
Orientation Sensors

Fastest Data Rates

Overview

MicroStrain's Inertia-Link® and 3DM-GX2® orientation sensors allow the user to set the data output rate of finished data quantities to suit varying applications. This technical note discusses the fastest data output rates that can be achieved with standard product without dropping packets.

This technical note assumes that:

- the user has a working knowledge of the Inertia-Link® and 3DM-GX2®;
- the user is familiar with the Inertia-Link® and 3DM-GX2® Data Communications Protocol;
- the user is building his own application.

As indicated in the Data Communications Protocol, the default rate for output of any particular data quantity is 100Hz. This setting can be changed by writing a value to EEPROM that changes the output rate. Please see the last section of this technical note for details.

Fastest data rates are achieved by operating the Inertia-Link® and 3DM-GX2® in Continuous mode and with the RS-232 or USB communication interfaces.

The following table details the command byte, data quantity, packet length, fastest data rate in packets per second and EEPROM setting.

Fastest Data Rates

Command Byte	Data Quantities	Packet Length	Data Rate in Packets/ Second	EEPROM Setting
0xC1	Raw Accelerometer and Angular Rate Sensors Outputs	31	187	274
0xC2	Acceleration and Angular Rate	31	187	274
0xC3	DeltaAngle and Delta Velocity	31	187	274
0xC5	Orientation Matrix	43	156	328
0xC6	Attitude Update Matrix	43	156	328
0xC7	Magnetometer Vector	19	237	216
0xC8	Acceleration, Angular Rate and Orientation Matrix	67	115	445
0xCB	Acceleration, Angular Rate and Magnetometer Vector	43	155	330
0xCC	Accel, Ang Rate, Mag Vectors and Orientation Matrix	79	102	502
0xCE	Euler Angles	19	218	235
0xCF	Euler Angles and Angular Rates	31	180	284
0xD2	Gyro Stabilized Acceleration, Angular Rate and Magnetometer Vector	43	155	330
0xD3	DeltaAngle, Delta Velocity and Magnetometer Vectors	43	155	330

Important Notes

- The rates are NOT valid for any standard Inertia-Link® or 3DM-GX2® with 2.4 GHz wireless interface; expect rates topping out at ~100 Hz.
- The rates are NOT valid for any OEM Inertia-Link® or 3DM-GX2®; rates up to 1000Hz can be achieved. Please contact MicroStrain for OEM configurations.
- The rates are NOT valid for any custom Inertia-Link® or 3DM-GX2® with RS-232 or USB interface with baud rates above 115.2 Kbaud; higher rates can be achieved with higher baud rates. Please contact MicroStrain for custom configurations.

Calculation Cycle and Data Output Rate

The on-board processor of the Inertia-Link® or 3DM-GX2® continuously executes a calculation cycle. The steps in this cycle include the following:

1. Convert raw sensor outputs into digital form
2. Scale sensor outputs into physical units (including temperature, alignment, and G-sensitivity compensation).
3. Propagate and filter the orientation estimate.
4. If host has issued a command byte (or if operating in continuous mode), compute appropriate response data and transmit.

Step 4 in this cycle is only executed if the Inertia-Link® or 3DM-GX2® has received a command byte from the host (or if the device is in continuous mode).

Fastest Data Rates

The calculation cycle continuously repeats itself (even if no data is requested by the host). The time required to complete a calculation cycle determines the fundamental limit on the maximum data output rate. Generally, only one new data record can be generated and output for each calculation cycle.

The duration of each calculation cycle is determined by the internal clock in combination with an adjustable divider

$$CalcPeriod = \frac{x}{51200}$$

Where

CalcPeriod	= duration of the calculation cycle in seconds
x	= divider constant

The maximum Data Output Rate is the inverse of CalcPeriod

$$DataRate = \frac{51200}{x}$$

Where

DataRate	= maximum data output rate in Hertz
x	= divider constant

DataRate quantifies the rate at which data records will be generated when running in continuous mode. In polled mode, this rate can also be achieved if the host program is capable of sending requests for data at a rate equal to or greater than the DataRate.

The factory default value of *x* is 512 giving a default data rate of 100Hz. *x* is stored as a 16 bit unsigned integer value in EEPROM address 0xFCA2. The value of *x* can be changed by utilizing the Write Word to EEPROM command. Valid values are within the range of 51200 (1Hz) to 170 (~300Hz).

MicroStrain®
MicroStrain, Inc.
310 Hurricane Lane, Unit 4
Williston, VT 05495 USA
www.microstrain.com
ph: 800-449-3878
fax: 802-863-4093
support@microstrain.com