# MEMSENSE

Customer Focused Inertial Solutions

# MS IMU 3030


LEADING PERFORMANCE FEATURES VALUE

**Product Specification & User Guide**

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Product Part Number: MP00066

Product Model Number: MS-IMU3030

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*MEMSENSE.COM*

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## 1.0 OVERVIEW

The MS-IMU3030 MEMS Inertial Measurement Unit delivers leading performance in a miniature package. The gyro bias instability of 0.55 °/h and accelerometer bias instability of 3.7 µ*g* supply ample inertial performance to support a wide range of applications from navigation and control to pipeline inspection. User configurable options allow the IMU to be tuned to your application with configurable bandwidth, sample rate, gyro ranges, accel ranges, 1 PPS input and other measurement parameters. An auxiliary accelerometer that can be configured to ±40 g allows incredible application tuning flexibility. The IMU provides all these features in a package that only measures 1.1 x 1.1 x 0.45 inches with a mass of only 25 grams. The MS-IMU3030's combination of inertial performance, size, and configurability surpasses all IMUs in the market.


## 2.0 SPECIFICATIONS

**Table 1 - Specifications**

| ACCELEROMETER IN PNS: | MP00066-001 & -002 | | | UNITS | NOTES |
|---|---|---|---|---|---|
| Dynamic Range | ± 2 | ± 4 | ± 8 | g | Note 1 |
| Bias Instability | 1.59<br>6.48 | | 1.94<br>6.93 | µ*g* | Typical XY<br>Typical Z |
| Bias Offset | ± 383<br>± 1959<br>± 485<br>± 1982 | | ± 341<br>± 1886<br>± 363<br>± 1880 | µ*g* | XY Typical<br>XY Maximum<br>Z Typical<br>Z Maximum, Note 2 |
| Bias Temperature Coefficient | 11.51<br>19.24 | | 9.92<br>18.37 | µ*g*/°C | Typical<br>Maximum, Note 3 |
| Nonlinearity | | | ± 0.3 | % of FS | Typical, Note 4 |
| Scale Factor Error | ± 1205<br>± 2088<br>± 3243<br>± 4700 | | ± 473<br>± 1340<br>± 354<br>± 1098 | ppm | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Scale Factor Temperature Coefficient | 7.14<br>12.86<br>17.36<br>20.96 | | 1.50<br>3.45<br>13.11<br>17.77 | ppm/°C | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Velocity Random Walk | 0.0050<br>0.0073 | | 0.0058<br>0.0079 | $m/s/h^{-1/2}$ | Typical XY<br>Typical Z |
| Noise Density | | | 20 | µ*g*/$Hz^{-1/2}$ | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Bandwidth | | | 50 | Hz | -3dB point, Note 5 |

| ACCELEROMETER IN PNS: | MP00066-003 & -004 | | | UNITS | NOTES |
|---|---|---|---|---|---|
| Dynamic Range | ± 10 | ± 20 | ± 40 | g | Note 1 |
| Bias Instability | | | 10.6 | μg | Typical |
| Offset | | | ±1400 | μg | Typical, Note 2 |
| Bias Temperature Coefficient | 18.46<br>33.70 | | 10.47<br>18.35 | μg | Typical<br>Maximum, Note 3 |
| Nonlinearity | | | ± 0.3 | % of FS | Typical, Note 4 |
| Scale Factor Error | ± 741<br>± 1813<br>± 2398<br>± 4178 | | ± 443<br>± 1023<br>± 323<br>± 1148 | ppm | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Scale Factor Temperature Coefficient | 11.51<br>24.86<br>31.19<br>41.07 | | 2.80<br>5.40<br>13.81<br>18.96 | ppm/°C | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Velocity Random Walk | | | 0.028 | $m/s/h^{-1/2}$ | Typical |
| Noise Density | | | 63.6 | $\mu g/Hz^{-1/2}$ | Typical |
| Bandwidth | | | 50 | Hz | -3dB point, Note 5 |

| ACCELEROMETER IN PNS: | MP00066-007 & -008 | | | UNITS | NOTES |
|---|---|---|---|---|---|
| Dynamic Range | ± 10 | ± 20 | ± 40 | g | Note 1 |
| Bias Instability | | | 10.6 | µg | Typical |
| Bias Offset | ± 1032<br>± 3653<br>± 1112<br>± 4159 | | ± 331<br>± 1809<br>± 309<br>± 1990 | µg | Typical XY<br>Maximum XY, Note 2<br>Typical Z<br>Maximum Z, Note 2 |
| Bias Temperature Coefficient | 18.46<br>33.70 | | 10.47<br>18.35 | µg | Typical<br>Maximum, Note 3 |
| Scale Factor Error | ± 741<br>± 1813<br>± 2398<br>± 4178 | | ± 443<br>± 1023<br>± 323<br>± 1148 | ppm | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Scale Factor Temperature Error | 11.51<br>24.86<br>31.19<br>41.07 | | 2.80<br>5.40<br>13.81<br>18.96 | ppm/°C | Typical XY<br>Maximum XY<br>Typical Z<br>Maximum Z |
| Nonlinearity | ± 0.3 | ± 0.3 | ± 0.3 | % of FS | Typical, Note 4 |
| Velocity Random Walk | 0.028 | 0.028 | 0.028 | m/s/h $^{-1/2}$ | Typical |
| Noise Density | 63.6 | 63.6 | 63.6 | µg/Hz$^{-1/2}$ | Typical |
| Bandwidth | | | 50 | Hz | -3dB point, Note 5 |

| ANGULAR RATE | | | | | | UNITS | NOTES |
|---|---|---|---|---|---|---|---|
| Dynamic Range | ± 75 | ± 200 | ± 480 | ± 960 | ± 1920 | °/s | Min, Note 1 |
| Bias Instability | | | | | 0.46<br>0.51 | °/h | Typical XY<br>Typical Z |
| Bias Offset | | | | | ± 14.20<br>± 100.00 | °/h | Typical<br>Maximum, Note 2 |
| Bias Temperature Coefficient | | | | | 0.58<br>1.20 | °/h/°C | Typical<br>Maximum, Note 3 |
| Bias G-Sensitivity | | | | | 2.19 | °/h/g | Typical |
| Scale Factor Error | | | | | ± 836<br>± 1870<br>± 629<br>± 1290 | ppm | XY Typical<br>XY Maximum<br>Z Typical<br>Z Maximum |
| Scale Factor Temperature Coefficient | | | | | 13.66<br>17.27<br>3.07<br>12.32 | ppm/°C | XY Typical<br>XY Maximum<br>Z Typical<br>Z Maximum |
| Nonlinearity | | | | | ± 0.05 | % of FS | Typical, Note 4 |
| Angle Random Walk | | | | | 0.114<br>0.106 | °/h $^{-1/2}$ | Typical XY<br>Typical Z |
| Noise Density | | | | | 0.003 | °/s /Hz$^{-1/2}$ | Typical |
| Bandwidth | | | | | 50 | Hz | -3dB point, Note 5 |

| MAGNETIC FIELD | NOTE 6 & 7 | UNITS | NOTES |
|---|---|---|---|
| Dynamic Range | ± 1.9 | gauss | Minimum |
| Offset | ± 0.005 | gauss | Typical |
| Noise Density | 79.2 | µgauss /$Hz^{-1/2}$ | Typical |
| Bandwidth | 50 | Hz | -3dB point |
| **DEVICE TEMPERATURE** | | **UNITS** | **NOTES** |
| Temperature Error | ± 1.5 | °C | Maximum |
| **1 PULSE PER SECOND INPUT** | | | |
| Voltage Low Level Input | 0.9 | V | Maximum |
| Voltage High Level Input | 2.1 | V | Minimum |
| Trigger Edge | Rising | | |
| **EXTERNAL TRIGGER INPUT** | | | |
| Voltage Low Level Input | 0.9 | V | Maximum |
| Voltage High Level Input | 2.1 | V | Minimum |
| Pulse Width | 1.0 | µs | Minimum |
| **TIME OF VALIDITY OUTPUT** | | | |
| Voltage Low Level Output | 0.4 | V | Maximum |
| Voltage High Level Output | 2.6 | V | Minimum |
| Rise and Fall Time | 30 | ns | Maximum |
| **PHYSICAL** | | **UNITS** | **NOTES** |
| Dimensions | 1.10 × 1.10 × 0.45 | in. | (L x W x H) |
| Mass | 25 | grams | |
| **OPERATIONAL REQUIREMENTS** | | **UNITS** | **NOTES** |
| Supply Voltage | 4.9 to 30.0 | VDC | |
| Supply Power | 1.35 | W | Typical |
| Operating Temperature | -40 to 85 | °C | |
| Interface Connector | Harwin Gecko G125-MS11005L | | 10 pin |
| Mating Connector | Harwin Gecko G125-2041096L0 | | 10 pin |
| **ABSOLUTE MAXIMUM RATINGS** | **NOTE 8** | **UNITS** | **NOTES** |
| Acceleration Powered | 800 | *g* | 0.5 ms any axis |
| Supply Voltage | -0.3 (min) to 36.0 (max) | VDC | |
| Storage Temperature | -55 to 85 | °C | |
| Maximum Digital Input, Unpowered | 3.3 | VDC | |

1. Dynamic ranges configurable see Section 4.4.4 Config Accel Range and Section 4.4.5 Config Gyro Range.
2. Bias Offset determine from maximum absolute bias at ambient temperature.
3. Bias Temperature Coefficient is determined from maximum minus minimum bias over operating environment temperature with ±1 ° C/min. gradient.
4. Nonlinearity is specified from -30 to 85°C. For gyros an input angular rate of ± 450 °/s is used.
5. Bandwidth is configurable see section 4.4.2 Configure Filter.
6. Typical Values at 25°C, 0 °/s, unless otherwise noted.
7. See Table 16 for applicability to model numbers.
8. Absolute Maximum Ratings list device survivability specifications and are non-operational.

# MS-IMU3030 ALLAN VARIANCE CURVES

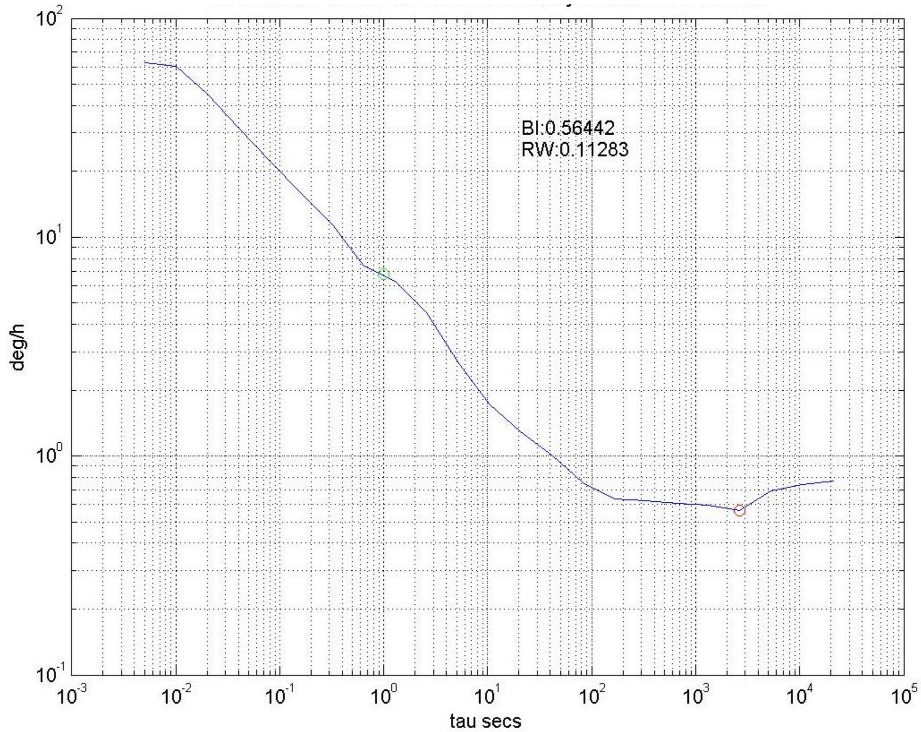


Figure 1 - MS-IMU3030 Gyro Root Allan Variance Obsolete

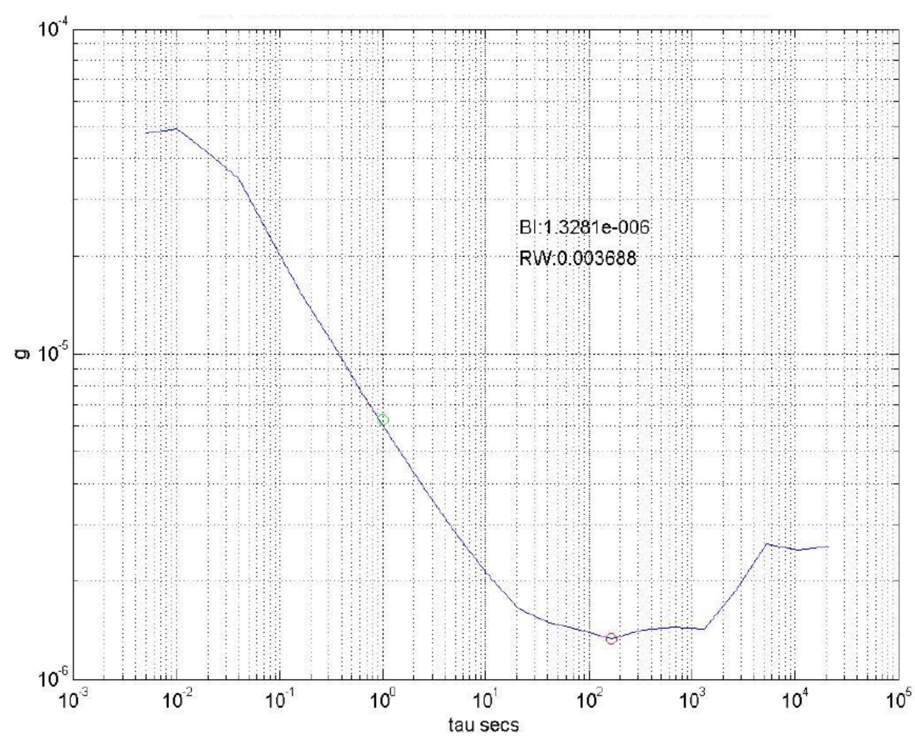


Figure 2 - MS-IMU3030 Primary Accel Root Allan Variance

# 3.0 MECHANICAL

## 3.1 Dimensions

The MS-IMU3030 is contained in a 6061-T6 aluminum housing anodized to MIL-A-8625 standards. Mounting of the IMU is achieved through four 2-56 captive socket head cap screws while alignment is facilitated through two one sixteenth inch dowel pins. The mounting surface of the mechanical interface is flat to within one one-thousandths of an inch. The dimensions below are only an overview of the housing, detailed mechanical drawings in Imperial and Metric units are provided at Memsense.com under the MS-IMU3030 product page.

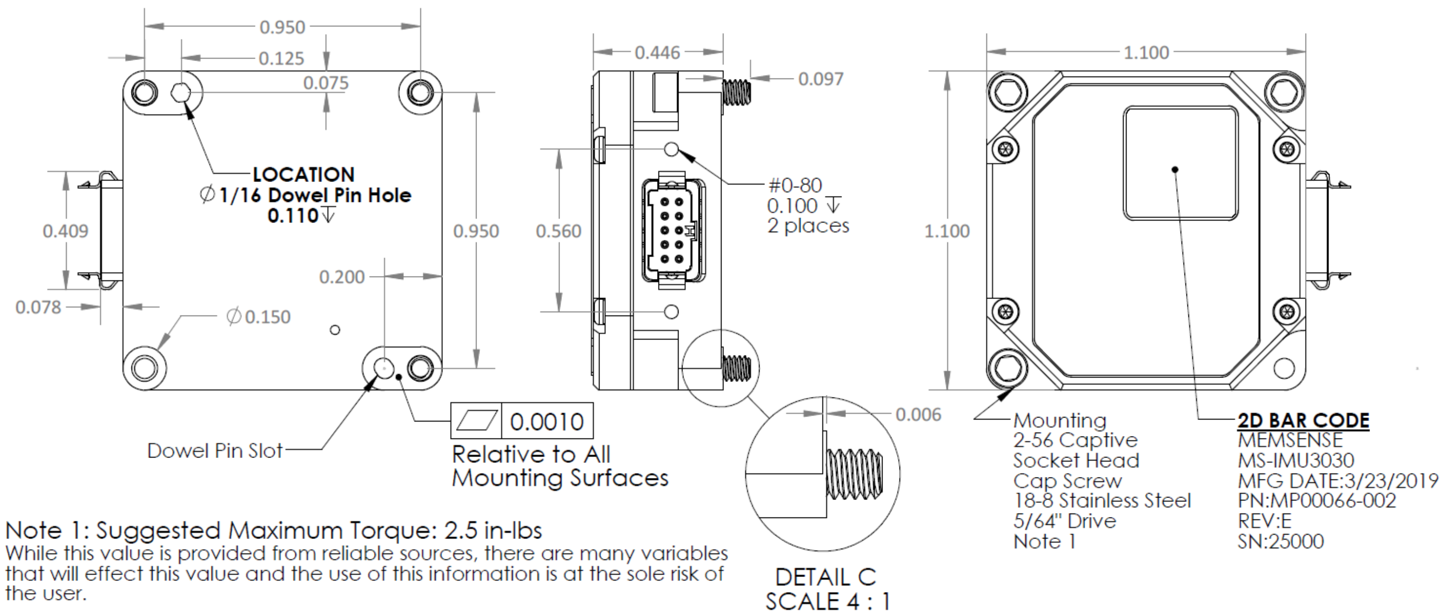


**Figure 3 - Physical dimensions (inches)**

### 3.2 Coordinate System

The coordinate system for the MS-IMU3030 follows the right-hand rule convention. As an example, with the IMU pictured in Figure 2, if the Z axis is pointed straight UP away from the earth, it will produce 0 *g* for the X and Y axes and a positive 1 *g* for the Z axis. A counterclockwise rotation of the IMU about any of the depicted axis will produce a positive angular rate output for the corresponding axis. The magnetometer sign convention produces a positive output on the corresponding axis aligned in the North direction with the IMU bottom parallel and facing the Earth's surface.

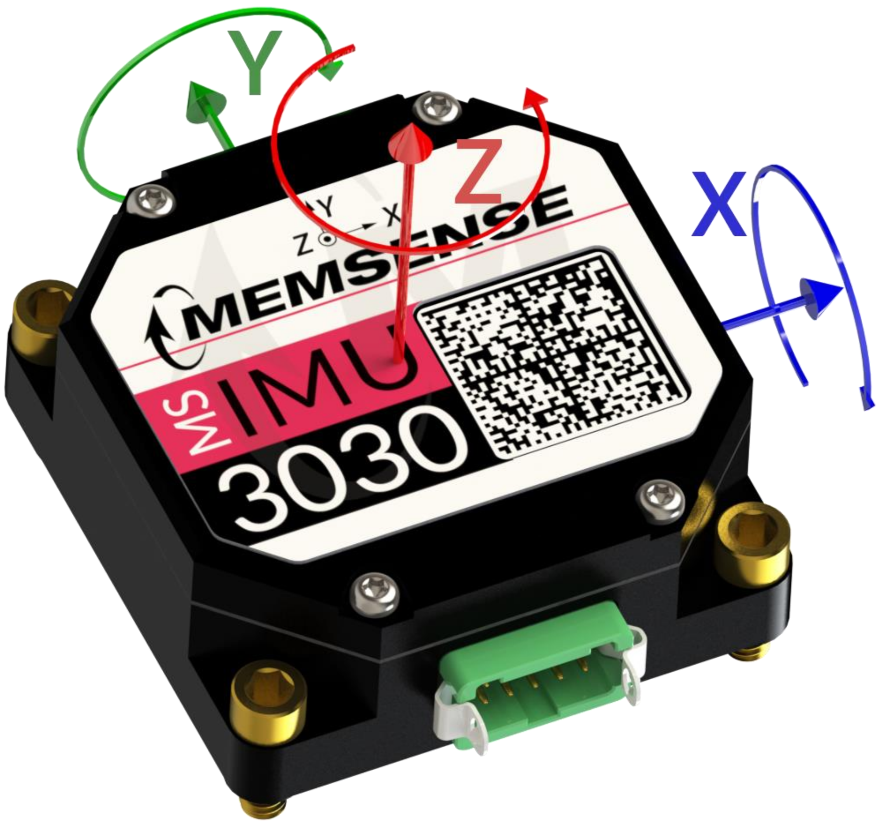


**Figure 4 – MS-IMU3030 coordinate system**

# 4.0 COMMUNICATIONS

## 4.1 Default Settings

The MS-IMU3030 is configured in manufacture to default settings. Knowledge of these settings is important when connecting to the IMU in the MS-CIP Evaluation Application. The following table provides the necessary default settings to connect to the IMU.

**Table 2 –IMU Default Settings**

| SETTING | DEFAULT |
|---|---|
| Baud Rate | 460800 bps |
| Start Bit | 1 |
| Stop Bit | 1 |
| Data Bits | 8 |
| Parity | None |

## 4.2 Hardware Interface

The MS-IMU3030 utilizes a 1.25mm pitch 10-pin Harwin Gekco connector for an electrical interface. The IMU connector manufacturer part number is G125-MS11005L with a mating connector manufacturer part number of G125-2041096L0. The IMU communications are transmitted and received via 3.0-volt level RS-422 physical signals. The electrical interface is further detailed in the figure and table below as well as sections 4.2.1 through 4.2.3.

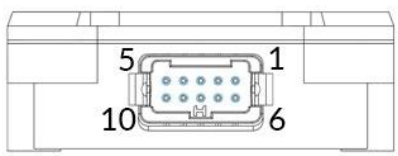


**Figure 5 – MS-IMU3030 electrical interface connector**

**Table 3 – MS-IMU3030 Signal Interface**

| PIN | SIGNAL NAME | DESCRIPTION |
|---|---|---|
| 1 | PWR | Power Supply Input |
| 2 | RSVD | Reserved |
| 3 | 1PPS | GPS 1 Pulse Per Second Input |
| 4 | RCV A | RS-422 Non-Inverting Input |
| 5 | RCV B | RS-422 Inverting Input |
| 6 | GND | Power Supply Return |
| 7 | TOV | Time Of Validity |
| 8 | X TRIG | External Trigger |
| 9 | TX Y | RS-422 Non-Inverting Output |
| 10 | TX Z | RS-422 Inverting Output |

### 4.2.1 Time of Validity Output – Internal Sample Rate

The *Time of Validity (TOV)*, pin 7, output provides a signal that indicates when the internal sensors are sampled at the internal sample rate and when the samples complete transmission. The TOV falling edge is correlated with sampling of the first element in a sample. The TOV rising edge occurs after the last bit of a sample has finished transmission. Figure 4 provides a timing diagram depicting the relation between the internal sample rate, sample transmission and the TOV output. See 4.1.2 External Trigger Input for TOV output with external trigger enabled.

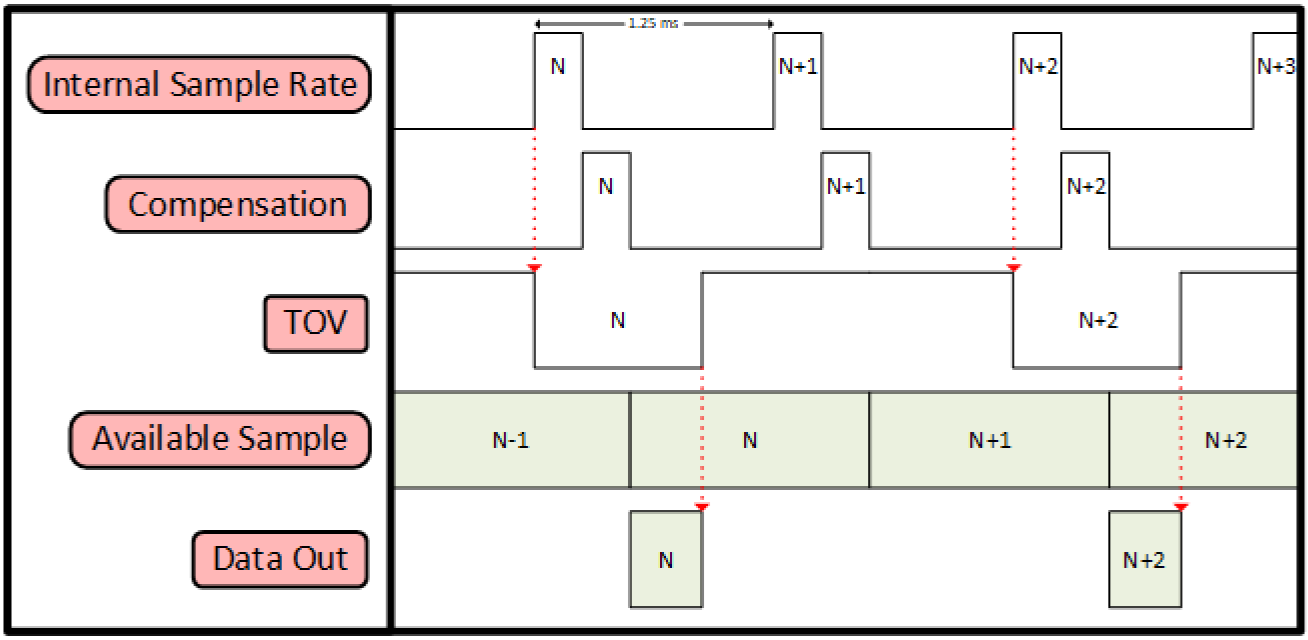


**Figure 6 – TOV timing diagram with output sample rate at decimation of 2.**

### 4.2.2 External Trigger Input

The *External Trigger (X TRIG)*, pin 8, input provides a means to synchronize the IMU's sample transmission with an external sampling period. A rising edge signal on the External Trigger input initiates the transmission of the most recent complete sample. When in the External Trigger Mode, the TOV falling edge occurs with the beginning of an internal sample and its rising edge is initiated by the completion of the sample's compensation. Figure 5 depicts the timing associated with the use of the External Trigger and its relation to the TOV signal.

Please note that the External Trigger Mode must be enabled through the communications protocol for the input to be active, see the protocol section or the MS-CIP specification for details on enabling or disabling the External Trigger.

### 4.2.3 1 Pulse Per Second Input

The *1 Pulse Per Second Input (1 PPS)*, pin 3, provides a means to synchronize the IMU's sample transmission with a GPS receiver's 1 pulse per second output.  A Rising Edge signal on the 1 PPS input time initiates a time reset to the nearest second.

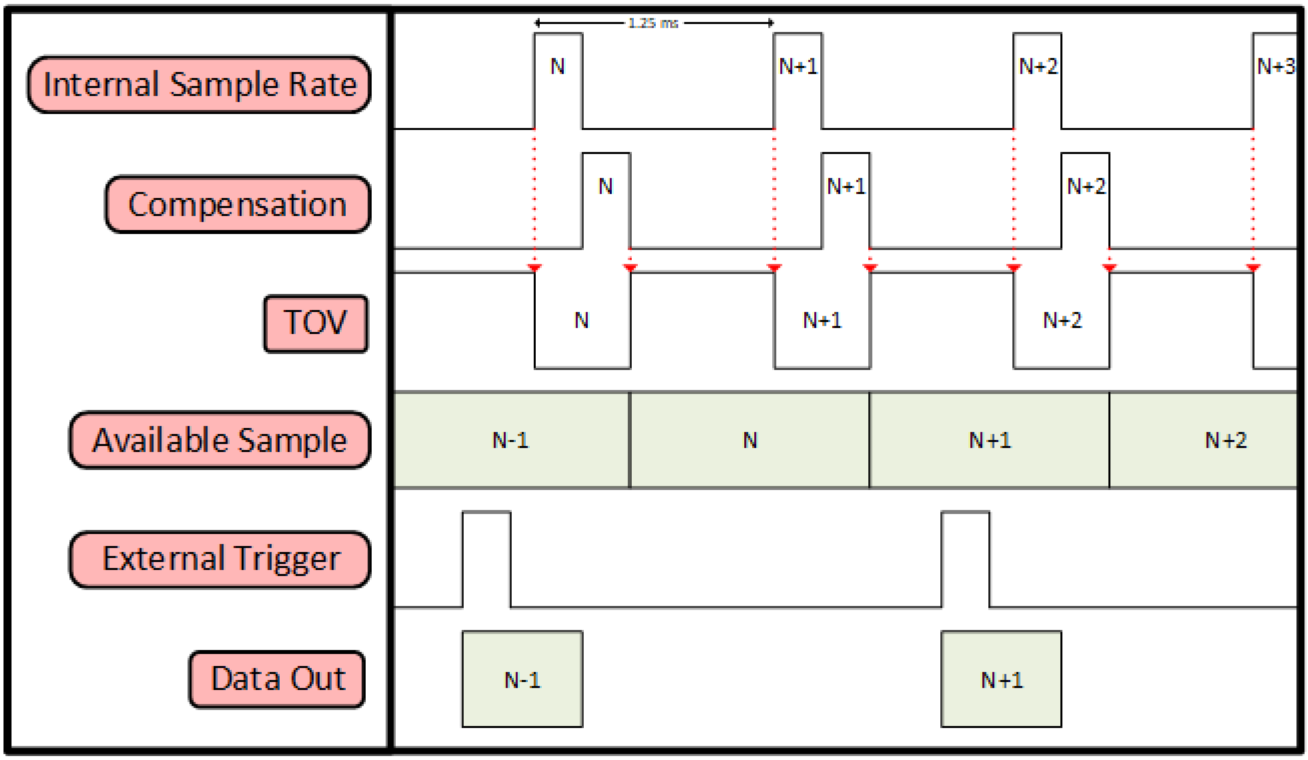


**Figure 7 – External Trigger timing diagram.**

## 4.3 Internal Sample Rate

The MS-IMU3030 internally samples sensors selected by the configuration at a rate of 800 samples per second. The internal sample rate is used in the output sample rate configuration detailed in the Memsense Communication Interface Protocol.

## 4.4 Communication Interface Protocol

*The communication interface protocol is defined in detail in the Memsense Communication Interface Protocol document (MS-CIP DOC00381) which can be found on the MS-IMU3030 product page at memsense.com.* The following information provides an overview and contains MS-IMU3030 specific portions of the communication protocol.

The Memsense Communication Interface Protocol (MS CIP) is implemented as a simple architecture to communicate information to and from the measurement device. The protocol is intended to be flexible in allowing customers to configure various features of the device achieving optimized communication modes for various application requirements. Below is a table showing the default output from the MS-IMU3030.

**Table 4 – Default IMU Data Message 0xA2**

| BYTE | BYTE NAME | VALUE | DESCRIPTION |
|---|---|---|---|
| 0 | Sync1 | 0xA5 | First synchronization value used in sample parsing. |
| 1 | Sync2 | 0xA5 | Second synchronization value used in sample parsing. |
| 2 | Message Type | 0xA2 | Message type identification code. |
| 3 | Payload Size | 0x1C | Byte length of the payload. |
| 4 | Message Code | 0x81 | Scaled Acceleration Vector identification code. |
| 5 | Data Size | 0x0C | Data Size in bytes. |
| 6 | X Accel MSB | 0x37 | X Accel in g. MSB of F32. |
| 7 | X Accel Byte 2 | 0xA7 | X Accel in g. Byte 2 of F32. |
| 8 | X Accel Byte 1 | 0xC5 | X Accel in g. Byte 1 of F32. |
| 9 | X Accel LSB | 0xAC | X Accel in g. LSB of F32. |
| 10 | Y Accel MSB | 0x37 | Y Accel in g. MSB of F32. |
| 11 | Y Accel Byte 2 | 0x7B | Y Accel in g. Byte 2 of F32. |
| 12 | Y Accel Byte 1 | 0xA8 | Y Accel in g. Byte 1 of F32. |
| 13 | Y Accel LSB | 0x82 | Y Accel in g. LSB of F32. |
| 14 | Z Accel MSB | 0x3F | Z Accel in g. MSB of F32. |
| 15 | Z Accel Byte 2 | 0x80 | Z Accel in g. Byte 2 of F32. |
| 16 | Z Accel Byte 1 | 0x00 | Z Accel in g. Byte 1 of F32. |
| 17 | Z Accel LSB | 0x65 | Z Accel in g. LSB of F32. |
| 18 | Message Code | 0x82 | Scaled Angular Rate Vector identification code. |
| 19 | Data Size | 0x0C | Data Size in bytes. |
| 20 | X Gyro MSB | 0x37 | X Gyro in degrees per second. MSB of F32. |
| 21 | X Gyro Byte 2 | 0xA7 | X Gyro in degrees per second. Byte 2 of F32. |
| 22 | X Gyro Byte 1 | 0xC5 | X Gyro in degrees per second. Byte 1 of F32. |
| 23 | X Gyro LSB | 0xAC | X Gyro in degrees per second. LSB of F32. |
| 24 | Y Gyro MSB | 0x37 | Y Gyro in degrees per second. MSB of F32. |
| 25 | Y Gyro Byte 2 | 0x7B | Y Gyro in degrees per second. Byte 2 of F32. |
| 26 | Y Gyro Byte 1 | 0xA8 | Y Gyro in degrees per second. Byte 1 of F32. |
| 27 | Y Gyro LSB | 0x82 | Y Gyro in degrees per second. LSB of F32. |
| 28 | Z Gyro MSB | 0x37 | Z Gyro in degrees per second. MSB of F32. |
| 29 | Z Gyro Byte 2 | 0x49 | Z Gyro in degrees per second. Byte 2 of F32. |
| 30 | Z Gyro Byte 1 | 0x53 | Z Gyro in degrees per second. Byte 1 of F32. |
| 31 | Z Gyro LSB | 0x9C | Z Gyro in degrees per second. LSB of F32. |
| 32 | Checksum 1 | 0x0C | Fletcher-16 checksum block 1 MSB |
| 33 | Checksum 2 | 0x23 | Fletcher-16 checksum block 2 LSB |
| Resulting Complete Command | | | |
| A5A5A21C810C37A7C5AC377BA8823F800065820C37A7C5AC377BA8823749539C0C23 | | | |

### 4.4.1 IMU Sample Rate Configure 0x0204

The *IMU Sample Rate Configure* provides a means to configure and save the rate at which all IMU data messages are transmitted. *IMU Message Config* is used to control individual measurements.

The *IMU Sample Rate Configure* function codes define the function to be performed on the device's inertial measurements. The associated codes and functions are listed in 5 below.

**Table 5 – IMU Sample Rate Function Codes**

| CODE | IMU SAMPLE RATE FUNCTION |
|---|---|
| 0X01 | Use new settings. |
| 0x02 | Request current settings. |
| 0x03 | Save current settings as startup settings. |
| 0x04 | Load saved startup settings. |
| 0x05 | Reset to default settings. |

A 16-bit decimation value must be provided and is used to divide the internal sample rate to the desired output sample rate. The MS-IMU3030 has an internal sample rate of 800Hz therefore providing a decimation value of 0x0008 (8 decimal) configures the output sample rate to 100Hz.

*See the MS-CIP at memsense.com under the MS-IMU3030 product page for more details regarding IMU Sample Rate Configure.*

### 4.4.2 Configure Filter 0x0203

The *Configure Filter* message provides a means for configuring and saving internal digital filtering options. The *Filter Function* allows the configuration to be used, queried, saved, loaded from startup settings, and reset to defaults. Table 6 details the associated codes and functions.

**Table 6 –Filter Function Codes**

| CODE | FILTER FUNCTION |
|---|---|
| 0X01 | Use new settings. |
| 0x02 | Request current settings. |
| 0x03 | Save current settings as startup settings. |
| 0x04 | Load saved startup settings. |
| 0x05 | Reset to default settings. |

The *Filter Control* codes allow filtering to be disabled or enabled in Infinite Impulse Response (IIR) mode. Care in selecting a filter bandwidth value that supports the Nyquist Sampling Theorem is suggested. The filter cutoff options listed here are specific to the MS-IMU3030. Filter cutoff options for the MS-IMU3030 are listed in Table 7.

**Table 7 – Filter Bandwidth Control Codes**

| CODE | FILTER CONTROL CODES |
|---|---|
| 0x00 | Disable Filter |
| 0x01 | IIR Filter -3 dB at 25Hz |
| 0x02 | IIR Filter -3 dB at 50Hz (Default) |
| 0x03 | IIR Filter -3 dB at 75Hz |
| 0x04 | IIR Filter -3 dB at 100Hz |
| 0x05 | IIR Filter -3 dB at 10Hz |
| 0x06 | IIR Filter -3 dB at 150Hz |
| 0x07 | IIR Filter -3 dB at 200Hz |

### 4.4.3 Select Sensors 0x0205

The *Select Sensors* message provides a means to configure and save the contents of the IMU data messages transmitted.

The *Select Sensors* function codes define the function to be performed on the device's message format. The associated codes and functions for the MS-IMU3030 are listed in Table 8 below.

**Table 8 – Select Sensors Function Codes**

| CODE | SELECT SENSORS FUNCTION |
|---|---|
| 0X01 | Use new settings. |
| 0x02 | Request current settings. |
| 0x03 | Save current settings as startup settings. |
| 0x04 | Load saved startup settings. |
| 0x05 | Reset to default settings. |

Table 9 lists the codes for the available measurements to be selected.

**Table 9 – Select Sensors Options**

| CODE | SELECT SENSORS OPTIONS |
|---|---|
| 0x81 | Scaled Acceleration Vector in *g* |
| 0x82 | Scaled Angular Rate Vector in deg/sec |
| 0x83 | Scaled Magnetic Field Vector in gauss |
| 0x84 | Delta Theta Vector in Radians |
| 0x85 | Delta Velocity Vector in m/s |
| 0x87 | Scaled Temperature in Celsius |
| 0x88 | GPS Correlated Time |

For each measurement selected the associated data code must be provided. When a Select Sensor message requests a sensor option that doesn't exist in the IMU (magnetometer or pressure), a NACK message will be returned.

*See the MS-CIP at memsense.com under the MS-IMU3030 product page for more details regarding Select Sensors.*

### 4.4.4 Config Accel Range 0x0207

The MS-IMU3030 supports the configuration of accelerometer dynamic ranges. The following configuration information details the options available and associated codes used in the communication protocol.

The *Config Accel Range* message provides a means for configuring and saving the triaxial accelerometer dynamic range options.

The *Config Accel Range Function* allows the configuration to be used, queried, saved, loaded from startup settings, and reset to defaults. Table 10 details the associated codes and functions.

**Table 10 –Config Accel Range Function Codes**

| CODE | CONFIGURE ACCEL RANGE FUNCTION |
|---|---|
| 0X01 | Use new settings. |
| 0x02 | Request current settings. |
| 0x03 | Save current settings as startup settings. |
| 0x04 | Load saved startup settings. |
| 0x05 | Reset to default settings. |

The *Accel Range* codes allow the dynamic range of the accelerometer to be changed to one of the 3 supported ranges and effect all three axes of the sensor. The options for the accelerometer dynamic range are controlled in the *Accel Range Codes* listed in Table 11.

**Table 11 – Accel Range Codes**

| CODE | ACCEL RANGE CODES | IMU MODEL NUMBER |
|---|---|---|
| 0x00 | Accelerometer range ±2 *g* | MS-IMU3030M<br>MS-IMU3030<br>MS-IMU3030MH<br>MS-IMU3030H |
| 0x01 | Accelerometer range ±4 *g* | MS-IMU3030M<br>MS-IMU3030<br>MS-IMU3030MH<br>MS-IMU3030H |
| 0x02 | Accelerometer range ±8 *g* | MS-IMU3030M<br>MS-IMU3030<br>MS-IMU3030MH<br>MS-IMU3030H |
| 0x03 | Accelerometer range ±10 *g* | MS-IMU3030ME<br>MS-IMU3030E<br>MS-IMU3030MHH<br>MS-IMU3030HH |
| 0x05 | Accelerometer range ±20 *g* | MS-IMU3030ME<br>MS-IMU3030E<br>MS-IMU3030MHH<br>MS-IMU3030HH |
| 0x06 | Accelerometer range ±40 *g* | MS-IMU3030ME<br>MS-IMU3030E<br>MS-IMU3030MHH<br>MS-IMU3030HH |

### 4.4.5 Config Gyro Range 0x0208

The MS-IMU3030 supports the configuration of gyroscope dynamic ranges. The following configuration information details the options available and associated codes used in the communication protocol.

The *Config Gyro Range* message provides a means for configuring and saving the triaxial gyroscope dynamic range options. The *Config Gyro Range Function* allows the configuration to be used, queried, saved, loaded from startup settings, and reset to defaults. Table 10 details the associated codes and functions.

**Table 12 – Config Gyro Range Function Codes**

| CODE | CONFIGURE GYRO RANGE FUNCTION CODES |
|---|---|
| 0X01 | Use new settings. |
| 0x02 | Request current settings. |
| 0x03 | Save current settings as startup settings. |
| 0x04 | Load saved startup settings. |
| 0x05 | Reset to default settings. |

The *Gyro Range* codes allow the dynamic range of the gyroscope to be changed to 1 of the 5 supported ranges and effect all 3 axes of the sensor. The options for the gyroscope dynamic range are controlled in the *Gyro Range Codes.* The MS-IMU3030 codes are listed in Table 11.

**Table 13 – MS-IMU3030 Gyro Range Codes**

| CODE | GYRO RANGE CODES |
|---|---|
| 0x06 | Gyroscope range ±75 °/s |
| 0x07 | Gyroscope range ±200 °/s |
| 0x03 | Gyroscope range ±480 °/s (Default) |
| 0x04 | Gyroscope range ±960 °/s |
| 0x05 | Gyroscope range ±1920 °/s |

# 5.0 OPTIONS

## 5.1 Part Numbering

The standard part numbers, sensor ranges and associated ECCNs for the MS-IMU3030 are listed in the table below. MS-IMU3030 models with part numbers from MP00066-001 to MP00067-006 are classified by ECCN for export. The remaining model numbers have yet to be classified. When purchasing an export-controlled model please contact sales for an End User Form.

**Table 14 - Standard part numbers**

| Model Number | Part Number | Accel (g) | Rate (°/s) | Mag (gauss) | ECCNs |
|---|---|---|---|---|---|
| MS-IMU3030M | MP00066-001 | ±2, ±4, or ±8 | ±75, ±200, ±480, ±960, or ±1920 | ±2 | 7A003 |
| MS-IMU3030 | MP00066-002 | ±2, ±4, or ±8 | ±75, ±200, ±480, ±960, or ±1920 | None | 7A003 |
| MS-IMU3030ME | MP00066-003 | ±10, ±20, or ±40 | ±75, ±200, or ±480 | ±2 | 7A994 |
| MS-IMU3030E | MP00066-004 | ±10, ±20, or ±40 | ±75, ±200, or ±480 | None | 7A994 |
| MS-IMU3030MHH | MP00066-007 | ±10, ±20, or ±40 | ±75, ±200, ±480, ±960, or ±1920 | ±2 | 7A003 |
| MS-IMU3030HH | MP00066-008 | ±10, ±20, or ±40 | ±75, ±200, ±480, ±960, or ±1920 | None | 7A003 |

## 5.2 MS-IMU3030 Accessories

Accessories available for the MS-IMU3030 include interface cables, a USB data acquisition module (USB-DAQ) and the MS-IMU3030 configuration software. The accessories allow an end user to rapidly connect, configure and collect evaluation data with the MS-IMU3030. The software provides valuable tools used in developing communications with the IMU. The table below provides the accessory part number details.

**Table 15 - Accessories part numbers**

| Model Number | Part Number | Description |
|---|---|---|
| C30X0-G10F-H6F-36 | MP00063-001 | MS-IMU3030 36-inch Development Interface Cable |
| C30X0-G10F-PTL-08 | MP00063-003 | MS-IMU3030 8-inch Unterminated Interface Cable |
| C30X0-G10F-PTL-12 | MP00063-004 | MS-IMU3030 12-inch Unterminated Interface Cable |
| USB-DAQ | MP00009-004 | MS-IMU3030 Specific USB Data Acquisition Module |
| MS-CIP-EVAL | N/A | MS-IMU3030 Configuration Software |

## 5.3 MS-IMU3030 Development Kit Part Numbering

Development kits available for the MS-IMU3030 are listed in Table 14 below and include a 36-inch development cable, a 12-inch pigtail cable, a USB data acquisition module, the MS-IMU3020 configuration software and the MS-IMU3020 model indicated in the table.

**Table 16 – Development kit part numbers**

| MODEL NUMBER | PART NUMBER | DESCRIPTION | ECCN |
|---|---|---|---|
| MS-IMU3030M Dev Kit | MP00072-001 | MP00066-001, MP00063-001, MP00063-004, MP0009-004 and MS-CIP Eval | 7A003 |
| MS-IMU3030 Dev Kit | MP00072-002 | MP00066-002, MP00063-001, MP00063-004, MP0009-004 and MS-CIP Eval | 7A003 |
| MS-IMU3030ME Dev Kit | MP00072-003 | MP00066-003, MP00063-001, MP00063-004, MP0009-004 and MS-CIP Eval | 7A994 |
| MS-IMU3030E Dev Kit | MP00072-004 | MP00066-004, MP00063-001, MP00063-004, MP0009-004 and MS-CIP Eval | 7A994 |
| MS-IMU3030MHH Dev Kit | MP00072-007 | MP00066-007, MP00063-001, MP00063-004, MP0009-004 and MS-CIP Eval | 7A003 |
| MS-IMU3030HH Dev Kit | MP00072-008 | MP00066-008, MP00063-001, MP00063-004, MP0009-004 and MS-CIP Eval | 7A003 |

## 6.0 DOCUMENT REVISION HISTORY

| REV | STATUS | DESCRIPTION | DATE |
|---|---|---|---|
| Prelim | Obsolete | Specification preliminary release. | 9-15-2017 |
| A | Obsolete | Original release | 2-13-18 |
| B | Obsolete | Corrected Table 7 to include the 150Hz filter option and the correct codes. Corrected the accelerometer configuration codes in Table 11. | 4-13-18 |
| C | Obsolete | Added 1PPS Input voltage level specifications. Added UART bit and parity specifications. RS-422 output voltage specifications. Added Development Kit Part Numbers. | 6-13-18 |
| D | Obsolete | Updated mechanical drawing. Updated product and document revisions. Added export ECCNs to development kit part number table. Moved document change history. | 4-13-18 |
| E | Obsolete | Removed MP00066-005 and MP00066-006 from available part numbers. | 11-6-18 |
| F | Obsolete | Updated mechanical drawing to include stainless steel mounting screw. Updated accel Allan Variance specifications and plot. Updated part number table to remove aux accel. | 10-28-2019 |
| G | Released | Corrected error pertaining to external trigger edge. External trigger is rising edge activation. Two associated figures were updated. | 3-9-2021 |

## 7.0 PRODUCT REVISION HISTORY

| REV | STATUS | DESCRIPTION | DATE |
|---|---|---|---|
| A | Released | Product initial release. | 5-2-2017 |
| B | Released | Added Time of Validity and External Trigger features. | 1-15-2018 |
| C | Released | IMU housing revision to facilitate an interface cable assembly with a back shell incorporating two 0-80 screw attachments. | 2-28-2018 |
| D | Released | Captive screw change from brass to 18-8 stainless steel. | 4-4-2019 |
| E | Current | IMU housing alignment pin hole geometry changed for improved alignment repeatability. | 7-17-2019 |