MEMSENSE

An **Inertial Labs** Company
Attitude is Everything

MS CIP Evaluation Application
COMMUNICATION INTERFACE PROTOCOL

USER MANUAL

Document Number: DOC00464
Document Revision: E

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1.0   OVERVIEW

The Memsense Communication Interface Protocol Evaluation Software (MS-CIP Eval SW) is implemented as a simple application to allow customers to rapidly connect to, configure and collect data from a Memsense Inertial Measurement Unit (IMU).

2.0   INSTALLATION

2.1   Default Settings

The MS-CIP Evaluation Software requirements are included in the table below.

Table 1 – System Requirements list

SYSTEM PARAMETER	REQUIREMENTS
Operating System	Windows 7 (.NET 4.5 or later) or newer
Minimum Graphics Resolution	1024 x 768
Graphics Device	DirectX 9 with WDDM 1.0 or higher driver
Minimum RAM	1 GB
USB Port	1 port available

2.2   Installation

The MS-CIP Evaluation Software can be downloaded by going to the Memsense website and selecting the Software tab under any of the product pages. Once at the Software tab, click the MS-CIP Evaluation Application Download option. Simply follow the installation instructions provided in the installer.

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3.0   APPLICATION OPERATION

3.1   Quick Start

1.Connect Green IMU end of Cable

Connect the green end of MS-IMU3020 interface cable to the MS-IMU3020
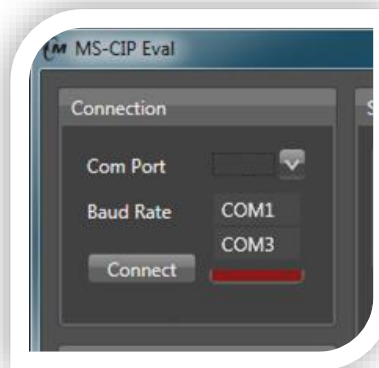

2.Connect the Black Circular Connector

Connect the black end of the MS-IMU3020 interface cable to the USB –DAQ.

3.Launch the MS-CIP Eval App

Start the MS-CIP Eval application from Start>All Programs>Memsense>MS-CIP Eval. Click the drop down arrow for the Com Port selection to view the available com ports as in the figure below.

4.Connect the Memsense USB-DAQ

Upon connecting the Memsense USB-DAQ to the USB port of the computer an additional com port associated with the USB-DAQ will appear in the Com Port drop down.
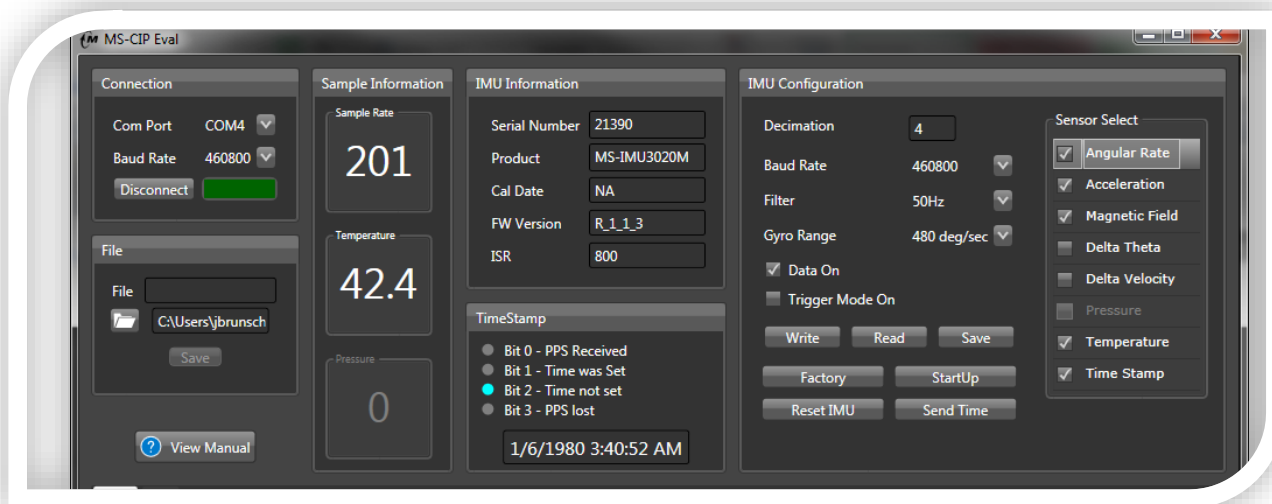
5. Select the Com Port

Select the com port that became available after plugging in the USB-DAQ.

6. Select the Baud Rate

Select 460800 bps from the Baud Rate options in the Connection window. The factory default baud rate for the MS-IMU3020 is 460800 bps, unless when ordering your device it was specified at a different factory default baud rate. If your device was ordered with a different baud rate then select that baud rate.

7. Click Connect

Click the Connect button in the Connection window. Upon clicking the Connect button the connection indicator turns from red to green indicating a successful connection. If the connection indicator turns yellow it usually means the baud rate doesn't match the device or a connector is disconnected.
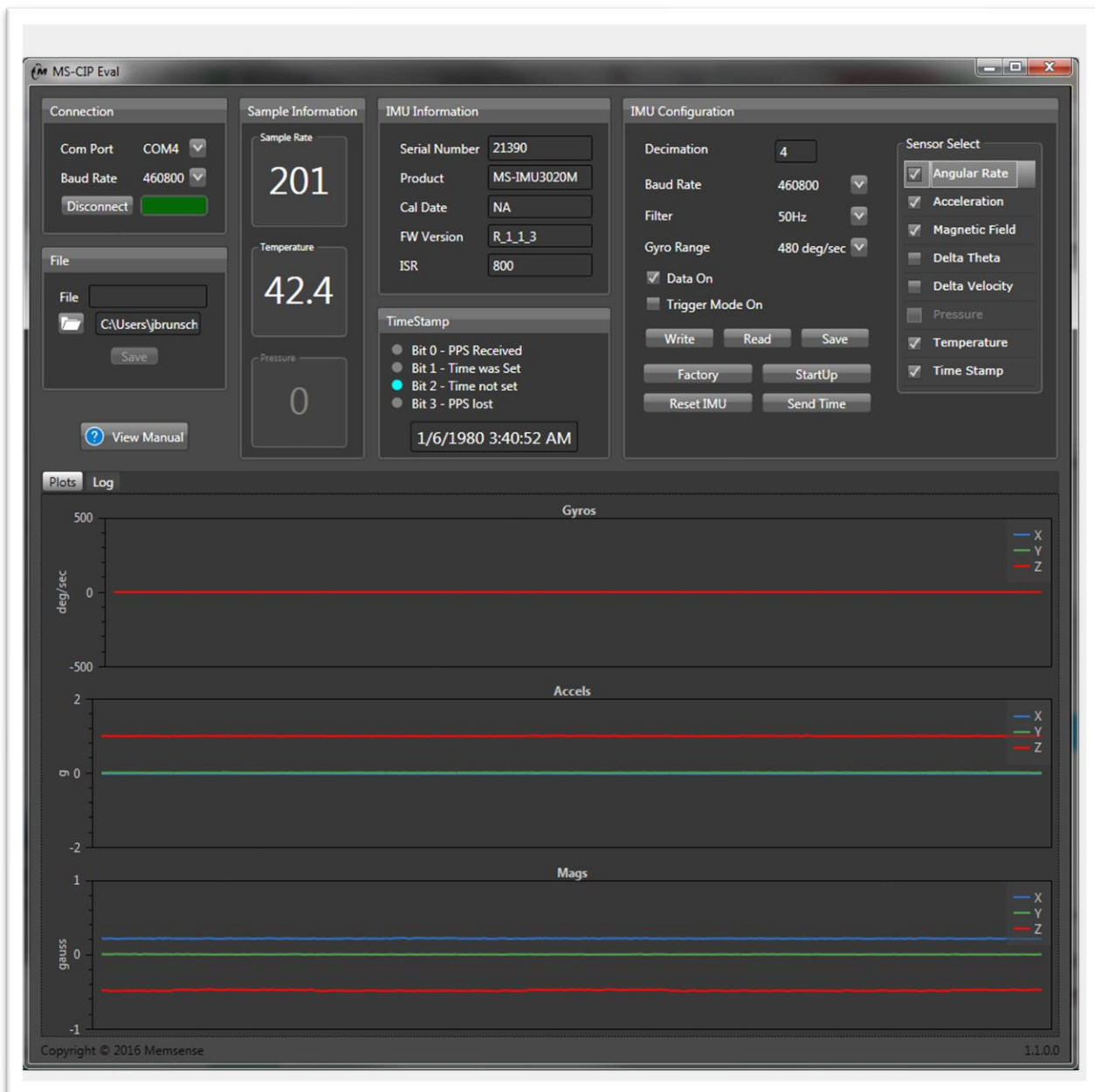
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3.2 Data Collection & Visualization

1.View Data Output Plots

The inertial sensor outputs are displayed in the lower portion of the application window under the plots tab. The plots provide a quick visual feedback of the IMU's operational status. The plots include gyros with an angular rate displayed in degrees per second, accelerometers in g, and magnetometers in gauss. The inertial data is plotted at one-tenth of the IMU configured output sample rate.

When any of the three sensor types plotted are deselected under IMU Configuration the corresponding plot will be removed from the display. This does not remove the sensor type from the IMU output until the write button is clicked.

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2.View IMU Communications Log

The IMU communications are displayed in the lower portion of the application window under the Log tab. The log displays the bidirectional communications with the IMU.   Transmissions to the IMU are denoted by hex alpha numeric strings following 'TX:' and are displayed in blue. Receptions from the IMU follow 'RX:' and are displayed in tan. Time of each communication is displayed in a hh:mm:ss.ssss format.

3.To Save Data

Under the File window area click into the File text field, type a file name, browse to a desired directory and click Save.

Once Save is clicked, the button label changes to Stop Saving. When data collection is complete click the Stop Saving button to end the collection.

4.Data Format

The saved data format will include the data elements from the Sensor Select check boxes arranged in columns. The order of the columns will follow the top down order of the check boxes with the exception that Timestamp will be the first column and the Timestamp flag byte will be the last column when selected.

Timestamp is formatted into dd/mm/yyyy hh:mm:ss.ssssss with hh in the 24h format. Note that the <space> between 'yyyy' and 'hh' will cause date and time to be separate columns when using space delimiting.

- Angular Rate data columns include the X, Y and Z angular rates in degrees per second.

- Acceleration data columns include the X, Y and Z accelerations in g.

- Magnetic Field data columns include the X, Y and Z magnetic fields in gauss.

- Delta Theta data columns include the X, Y, and Z angle difference from the previous sample in radians.

- Delta Velocity data columns include the X, Y, and Z velocity difference from the previous sample in m/s.

- Pressure data column includes the atmospheric pressure in millibars.

- Temperature data column includes the IMU internal temperature in degrees Celsius.

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3.3   IMU Configuration

1.Overview

IMU configuration is achieved through the controls contained in the IMU Configuration window located in the upper right corner of the MS-CIP Eval application. Care should be taken when changing the Baud Rate. Following the Baud Rate process below allows simple configuration of the baud rate.
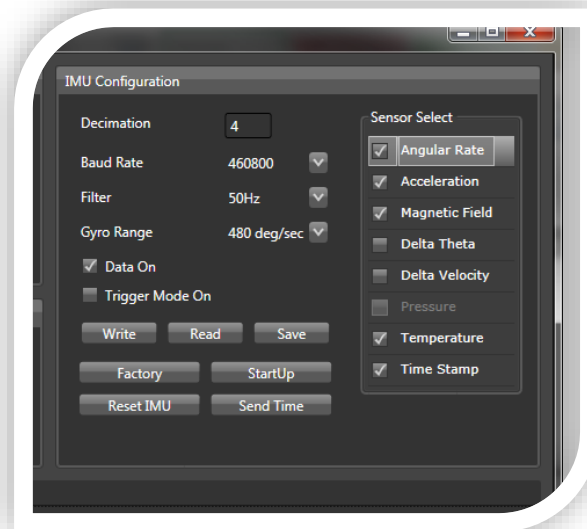
2.Decimation

The Decimation value is a used to decimate the internal sample rate to obtain an output sample rate. The Decimation value can be set to an integer number between 1 and 1000. *If the sample rate change increases the data throughput to a level higher than is supported by the configured baud rate, checksum errors will occur.*

3.Baud Rate

The Baud Rate controls the IMU baud rate setting. When changing to a new baud rate select the desired baud rate in the IMU Configuration window and click Write. Connection will be lost indicated by a yellow connection indication. Click disconnect in the Connection window. Next in the Connection window change the baud rate to match the newly selected IMU baud rate and click connect. Successful connection will be indicated by the Connection indicator turning green. If the new IMU Baud Rate is desired to be the default startup setting click the Save button in the IMU Commands window.

The available baud rate settings are: 921600 bps, 460800 bps, 230400 bps, 115200 bps, 57600 bps, 19200 bps, and 9600 bps. The Factory default Baud Rate setting is 460800 bps.

4.Filter

The Filter setting allows the internal low pass filter -3db cutoff to be configured. The available settings are 10 Hz, 25 Hz, 50 Hz, 75 Hz, 100 Hz, 150 Hz and 200 Hz. Please note that the sample rate should be adjusted to be at least two times the Filter setting to support the Nyquist sampling theorem. The table below provides the decimation for the lowest sample rate associated with each bandwidth.

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Table 2 – Decimation for the lowest sample rate associated with each bandwidth

FILTER CUTOFF(HZ)	SAMPLE RATE (SPS)	DECIMATION
10	20	40
25	50	16
50	100	8
75	160	5
100	200	4
150	400	2
200	400	2

5.Gyro Range

The Gyro Range drop down allows the setting of the gyro's maximum dynamic range. Click the down arrow and select the dynamic range desired then click the write button. If the range selected is desired as a startup range then click the Save button. The gyro dynamic range options vary by IMU model.

6.Data On

The Data On check box allows data outputs to be enabled and disabled.

7.Write

The Write button writes the settings contained in the IMU Commands window to the connected IMU.

8.Read

The Read button requests the current settings from the connected IMU.

9.Save

The Save button saves the IMU's current settings as startup settings.

10.Factory

The Factory button reads the factory default settings from the connected IMU.

11.Startup

The Startup button reads the startup default settings from the connected IMU.

12.Sensor Select

Sensor Select options are listed on the right side of the IMU Commands window and allow the user to configure which sensor measurements are to be included in the IMU out data. After selecting or deselecting measurements clicking Write configures the IMU and clicking Save sets the configuration as the default startup configuration.

13.Trigger Mode On

When Trigger Mode On is selected and a write performed the external trigger input initiates a sample. If there is no trigger pulse on the input then the IMU will stop sampling. See the IMU user manual for input requirements.

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3.4 Sample Information

1.Sample Rate

The number of samples per second that are collected from the IMU.

2.Temperature

The IMU temperature in degrees Celsius.

3.Pressure

The atmospheric pressure in millibar. If the model number of the IMU doesn't include pressure or the Sensor Select command has been used to deselect pressure measurements the pressure display will read 0 and be greyed out.

3.5 IMU Information

1.Serial Number

The unique serial number of the IMU.

2.Product

The product model.

3.Cal Date

The date at which the IMU calibration was programmed.

4.FW Version

The version of the firmware programmed on the IMU.

5.ISR

The internal sample rate of the IMU in samples per second.

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3.6 Timestamp

1.Bit 0 – PPS Received
Set to indicate GPS 1 PPS received.

2.Bit 1 – Time was Set
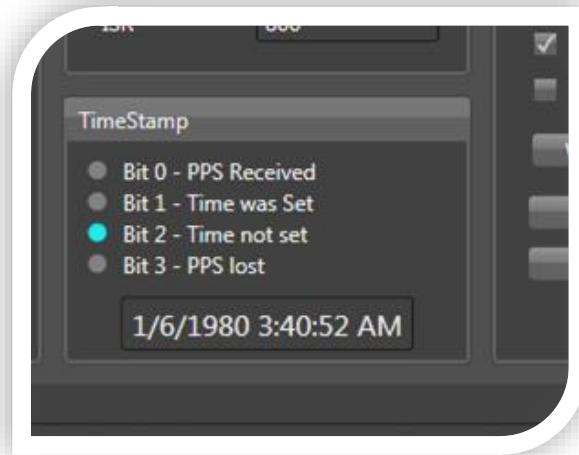Set to indicate GPS Time was set.

3.Bit 2 – Time not Set
No GPS Time Set, Using GPS Week 0 and Time 0

4.Bit 3 – PPS Lost
No 1 PPS received

5.Timestamp Display
Displays the Timestamp starting from GPS Week 0 and Time 0 if no GPS time is set. When the GPS time was set then the Timestamp increments from the set time. Time adjustments are performed when GPS time is set and 1 PPS is received.

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4.0 DOCUMENT REVISION HISTORY

REV	STATUS	DESCRIPTION	DATE
A	Obsolete	Initial Release	3-4-2016
B	Obsolete	Updated plot functionality Added Timestamp Flag byte description to Data Format Updated Delta Theta and Velocity descriptions. Updated pressure display details Added External Trigger Description Added Timestamp section.	6-24-2016
C	Obsolete	Corrected error relative to IMUs supported.	4-3-2019
D	Obsolete	Removed reference to IMUs supported.	7-25-2019
E	Released	Changed the document layout.	03-22-2024