

imu reader 0.1  
User manual

David Buckingham  
Eric Tytell  
Cassandra Donatelli  
Margo



## Contents

0.1	Copyright and License . . . . .	4
0.2	Introduction . . . . .	4
0.3	Hardware . . . . .	4
0.3.1	PC . . . . .	4
0.3.2	Arduino . . . . .	4
0.3.3	IMUs . . . . .	4
0.4	Installation . . . . .	4
0.4.1	Arduino code . . . . .	5
0.5	Equipment setup . . . . .	5
0.6	Collecting data . . . . .	7
0.7	Processing data . . . . .	7
0.8	Saving and loading . . . . .	7
0.8.1	.csv file format . . . . .	7
0.9	Settings . . . . .	7
0.10	Troubleshooting . . . . .	7
0.10.1	Error messages . . . . .	7

## 0.1 Copyright and License

imu reader: a tool for collecting IMU measurements. Copyright (C) 2017 Author(s)??????/

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program. If not, see <<http://www.gnu.org/licenses/>>.

## 0.2 Introduction

## 0.3 Hardware

imu reader interconnects three pieces of computational hardware:

1. a PC
2. an Arduino
3. between 1 and 3 Inertial Measurement Units (IMUs)

### 0.3.1 PC

imu reader has been tested on PCs running Linux (Linux Mint 18 Sarah), macOS (Need to test this and put version), and Windows (Version??). It uses multi-threading and will perform best if multiple processing units (cores) are available.

### 0.3.2 Arduino

imu reader has been tested with an Arduino UNO. It is expected to work on other models having the same clock speed (16MHz) and sufficient storage.

### 0.3.3 IMUs

The mpu9250 by InvenSense is nine-axis (gyroscope, accelerometer, compas) motion tracking device.

## 0.4 Installation

imu reader requires Python3.

We recommend using pip to install imu reader: <https://pypi.python.org/pypi/pip>

```
# pip install --upgrade pip # pip install imu reader
```

Pip will automatically install any of the following dependencies if needed:

- h5py
- numpy
- pyqtgraph
- pyserial
- pyqt5

### 0.4.1 Arduino code

#### Arduino IDE

Download and install the Arduino IDE. The software can be downloaded from: <https://www.arduino.cc/en/Main/Software>. Alternatively, Arduino can be installed on Debian systems with: `# apt-get install arduino-core`

#### Install imu reader on the Arduino

Install the file `am_tx/am_tx.ino` on the Arduino. This can be accomplished using the Arduino IDE graphical user interface.

Alternatively, using Arduino IDE version 1.5.0 or later, the Arduino can be programmed directly from the command line: `# arduino upload am_tx/am_tx.ino` For more information, see: <https://github.com/arduino/Arduino>

## 0.5 Equipment setup

Wire the IMU's to the Arduino, either directly or via a breadboard. [Wiring diagram??]

It is recommended to power the Arduino with an external power source instead of relying on the computer's USB port.

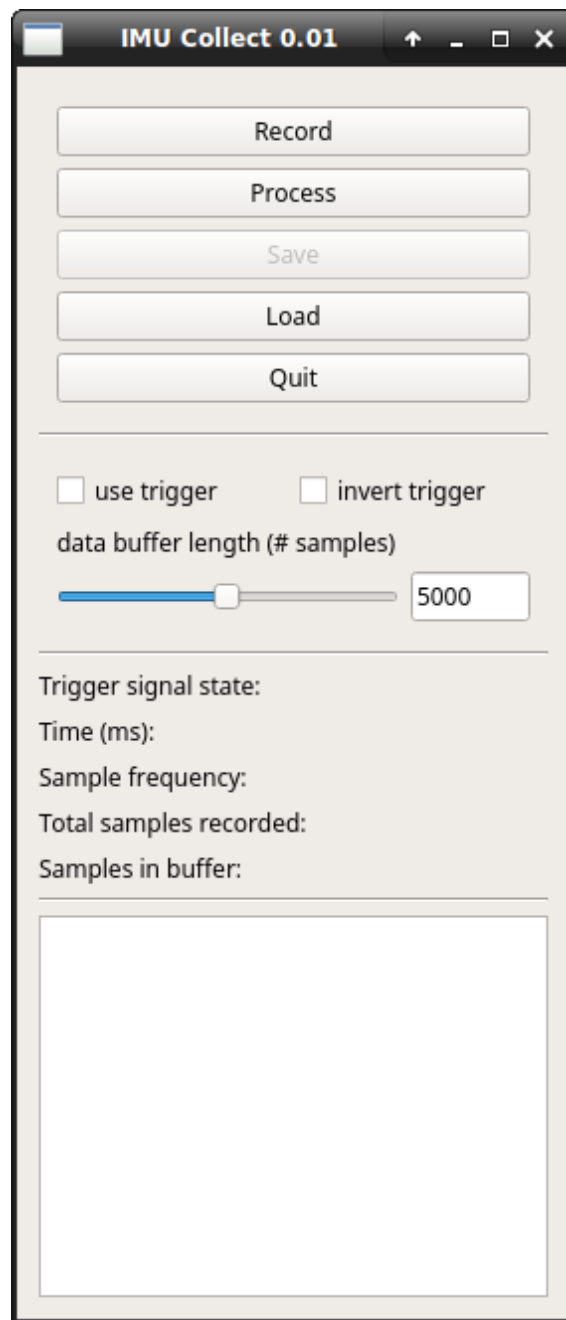


Figure 1: Control panel

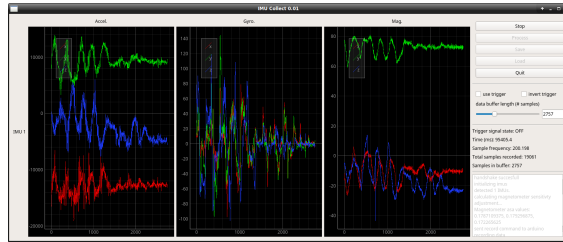


Figure 2: Collecting data from a single IMU

## 0.6 Collecting data

## 0.7 Processing data

## 0.8 Saving and loading

### 0.8.1 .csv file format

## 0.9 Settings

## 0.10 Troubleshooting

### 0.10.1 Error messages

#### invalid csv file

The program attempted to read a .csv file, but the format of the data in the file was not valid. See Section [0.8.1](#) for a description of the .csv file format used by imu reader.

#### invalid file type: ...

#### rx failed, no data read from serial

#### no Arduino found

#### failed to create connection

#### handshake failed

#### no connection, aborting

**unable to determine number of IMUs, aborting**

The program failed to determine how many IMUs are attached to the Arduino. After the Arduino is initialized, it attempts to determine the number of IMUs by sending a WHOAMI request while signaling each of the three legal chip select pins (Section ??). It then sends a message to the PC reporting the number of IMUs detected. This error is reported if the PC program sends a command to the Arduino to initialize, but does not receive a message reporting the number of IMUs detected. Make sure that any IMUs are correctly wired to the Arduino (Section ??) and that the correct code is installed on the Arduino (Section [0.4.1](#)), and try resetting the Arduino.

**no IMUs detected, aborting****ASA read failed, using 1 adjustment****Sample packet too short: ...**