PYREOS

Rev. 1.1

ezPyro™ Gesture / Motion Evaluation Kit User Manual

For low cost, low power, non-contact mid IR gesture and motion/presence sensing

CONTENTS

Please note: *the information contained in this document is subject to change without further notification.*

1 Introduction

This document describes the ezPyro™ Gesture/Motion Recognition Evaluation Kits and the related software. The purpose of these kits is to enable engineers and technicians to carry out simple and effective evaluation of ezPyro™ Gesture/Motion sensors, experiment with a sample Gesture/Motion Recognition algorithm, and to capture measured data to a PC.

There are four variants of the ezPyro™ Gesture/Motion Recognition Evaluation Kit, see Table 1.

The kits are based on the ST microelectronics STM32F303K8 microcontroller.

Please note: *The software discussed in this document can only be used with the ezPyro™* Gesture/Motion Recognition *Evaluation Kits.*

2 Getting Started

2.1 Hardware Variants

Figure 3: ezPyro™ Long Range Gesture Kit

Figure 3: ezPyro™ Mid-Range Gesture Kit

Figure 3: ezPyro™ Motion Kits

Evaluation Kit Name	Evaluation Kit Code	Number of Pixels	Aperture size	Optics	Algorithm
ezPyro™ Long Range Gesture	dPYEGE01	2x2	1.65 mm	Lens (f=6.35mm)	Directional
ezPyro™ Mid-Range Gesture	dPYEGE02	2x2	0.90mm	Window Only	Directional
ezPyro™ Motion/Presence Recognition	dPYEMO01	1	1.65mm	Lens (f=19.5mm)	Non-Directional
ezPyro™ Motion Direction	dPYEMO02	2x2	1.65mm	Lens (f=19.5mm)	Directional

Table 1: ezPyro™ Motion/Gesture Recognition Evaluation Kit variants

2.2 Kit contents

1. ezPyro™ Gesture/Motion Evaluation Kit
2. Micro USB-to-USB cable
3. ezPyro™ Gesture/Motion Recognition software (Setup file included in software package)
4. USB drive with software and documentation

2.3 Minimum system requirements

1. Microsoft® Windows PC (all versions supported currently)
2. GB of RAM
3. 450 MB of available hard-disk space for installation, additional free space required for storing CSV files
4. 1024x768 display (1280 x 1024 recommended)
5. Local administrative rights to install device drivers
6. .NET Framework 4.5
7. 1 free USB port

3 Installation

3.1 Install the ezPyro™ software

From the software pack included with the kit, select the "setup.exe" file that has this icon. This will start the installation process.

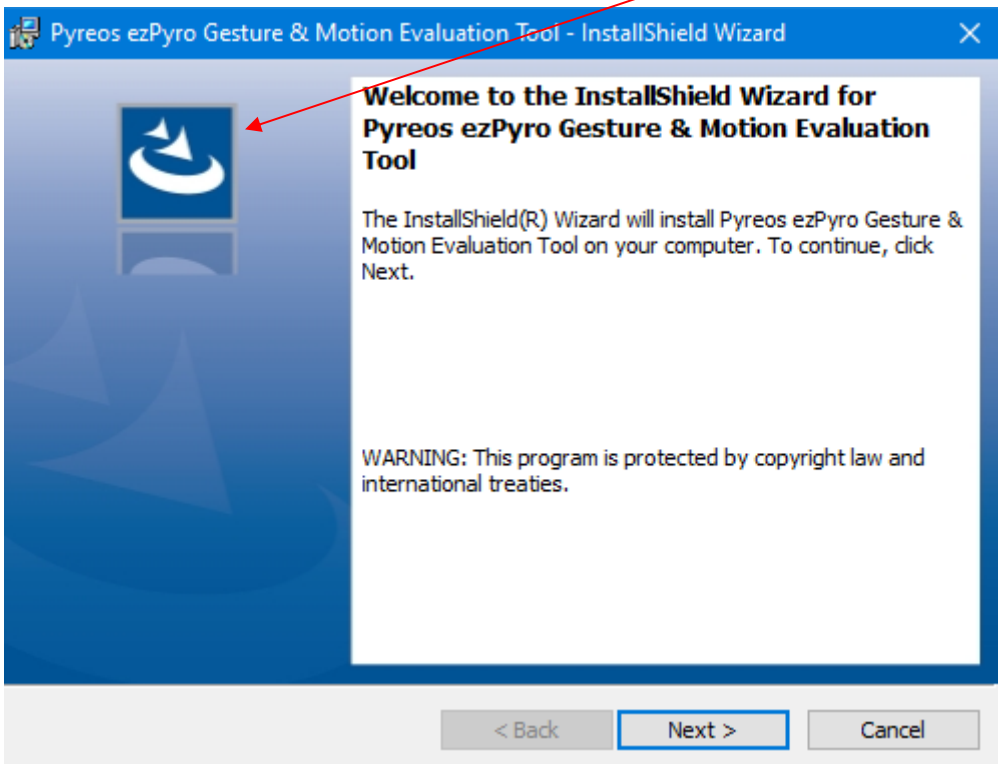

Figure 4: Installer window

Follow the on-screen instructions and enter the information required.

As part of the installation process a check will take place to see if .NET Framework 4.5 is present. If not, the setup routine can be cancelled and the .NET framework 4.5 can be downloaded from Microsoft's website.

A driver is needed for the STM32F303K8T6 microcontroller. This is included in the software package.

4 Installing the ST Microcontroller USB Driver

The USB supplied contains a folder called "en.stsw-link009.zip". Extract the files and run either the application "dpinst_amd64.exe" if you have a 64bit system or "dpinst_x86.exe" if you have a 32bit system. This will install the USB driver for the ST microcontroller that is connected to the ezPyro™ board.

Once the driver has been installed the USB cable can be connected between the ezPyro™ Board and the computer.

Once connected the green light on the ezPyro™ board will be on constantly and the red light will flash (The microcontroller is the inverse of this, red is on constantly and green flashes).

4.1 Installing .NET 4.5 framework

If you do not have the .NET 4.5 framework installed on your computer, then use the installer provided ("dotnetfx45_full_x86_x64") in the software package.

5 Connect the demo kit

Connect the USB cable to the kit and Windows PC.

You may see a message suggesting you are required to install a device driver. Follow the on-screen instructions and download a driver from Windows Update or install from the software package provided.

6 Running the Software

Double clicking on the .exe file will open the application. This will open the window shown below:

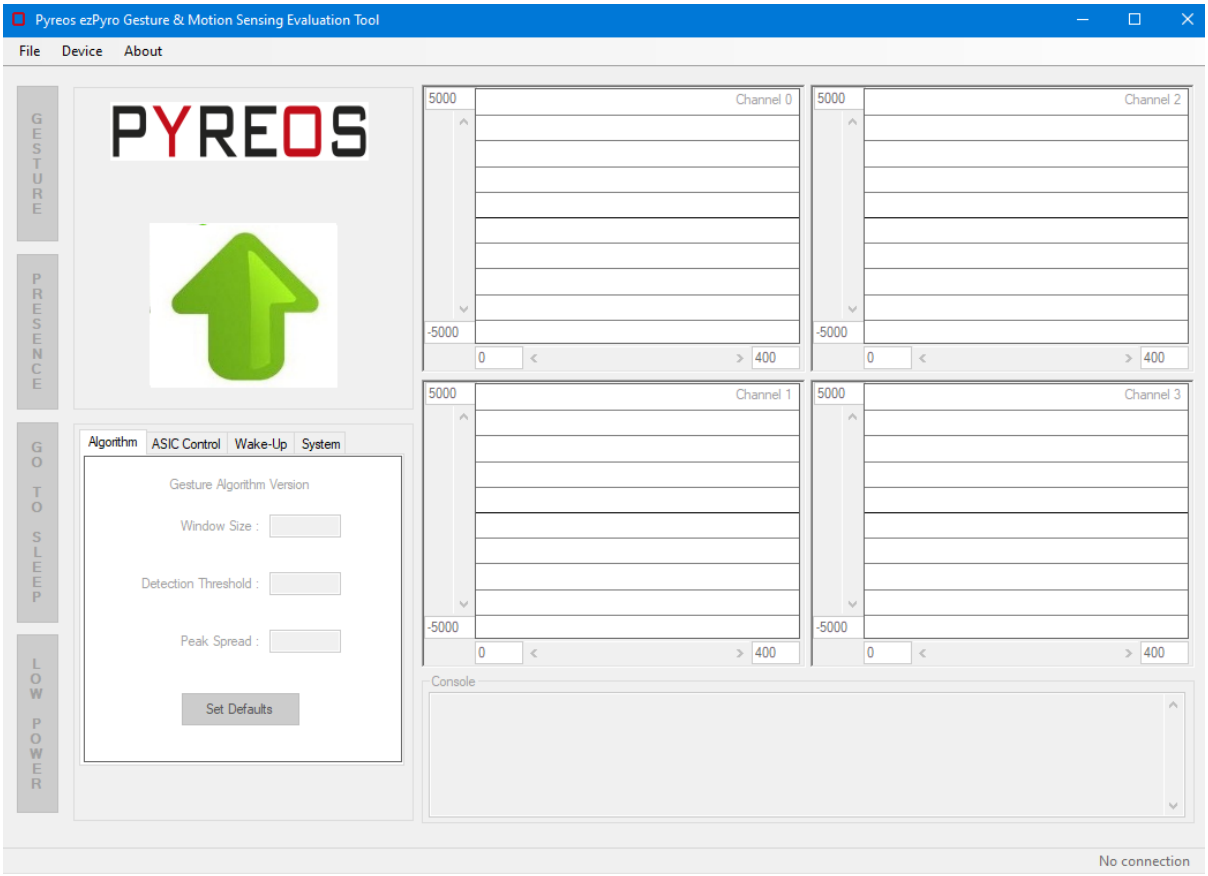

Figure 5: Main window with no device connected

To connect to the demo kit, select the Device -> Connect to Device

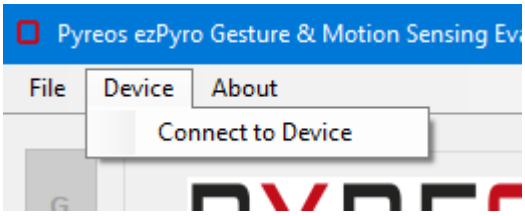

Figure 6: Connecting to an ezPyro™ device

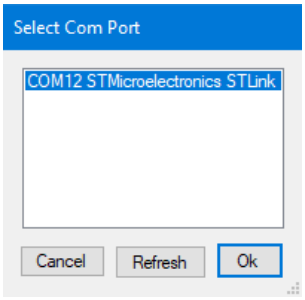

Figure 7: Com Port selection

This will open a window with all available devices on COM ports.

Connect to the port that is listed once the device is connected. If more than one COM port is listed this can be checked by disconnecting the device and refreshing the list. Re-connect and refresh the list then select the COM port that has appeared and click OK.

Once the device has been selected the software runs through a calibration sequence, during which the arrow that indicates a gesture direction will spin round and then vanish upon completion of the calibration. This is required when using the device without a method of stopping drafts from running across the device.

6.1 Different Variations

The software will work out when it is plugged in which kit it is attached to. The left side of the window then shows the current sensing mode. The button for the active mode, gesture, direction, or presence, is highlighted in blue. Using kits dPYEGE01, dPYEGE02 or dPYEMO02 allows access to gesture/direction and presence sensing. dPYEMO01 only allows access to presence sensing.

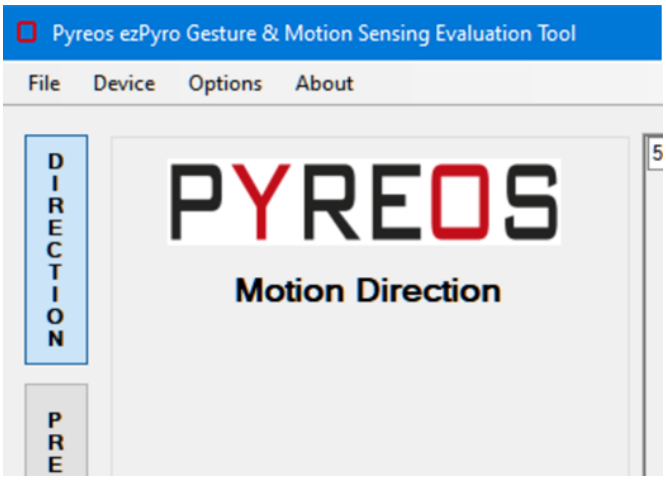

Figure 8: Motion Direction (dPYEMO02)

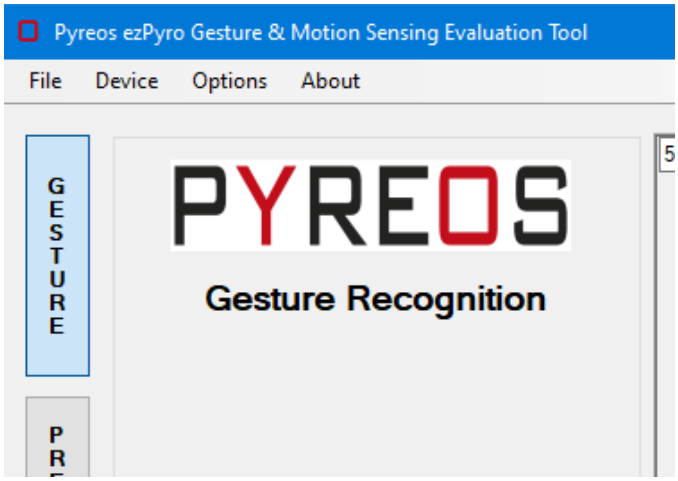

Figure 9: Gesture Recognition (dPYEGE01 and dPYEGE02)

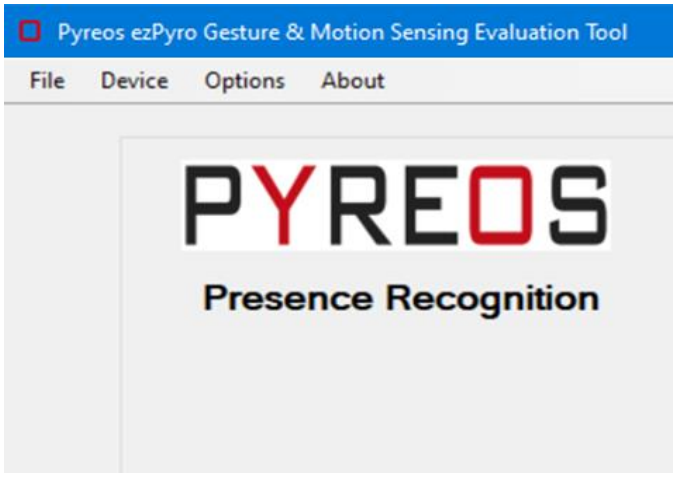

Figure 10: Presence Recognition (dPYEMO01)

The main window includes four scopes which show the signals produced by each of the pixels in the sensor as shown in Figure 11. The scope settings can be altered using the sliding scales on the x-axis and the y-axis.

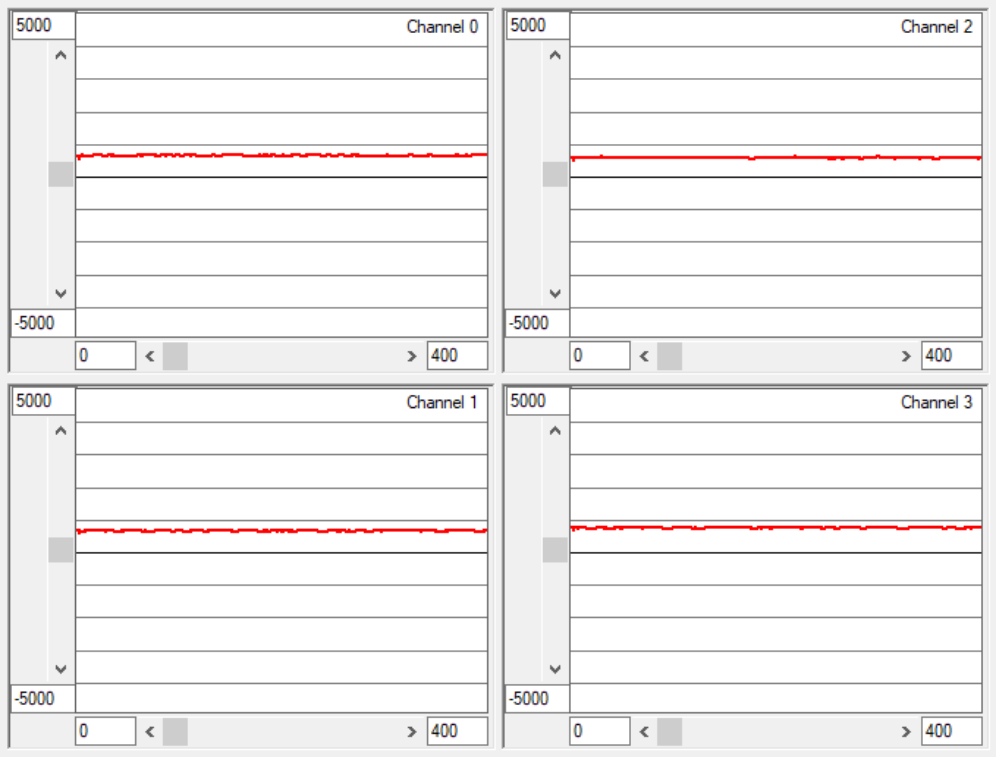

Figure 11: Scope layout

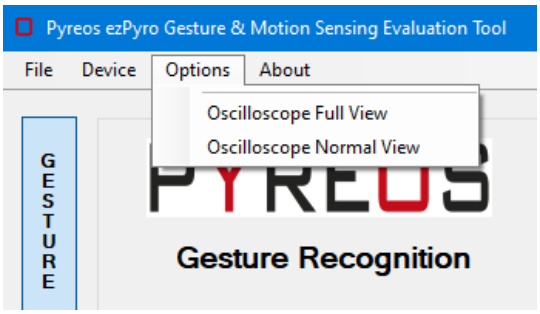

Figure 12: Options menu

By selecting Oscilloscope Full View in the Options menu, the sliding scales can be removed.

This allows the scopes to be viewed without distraction.

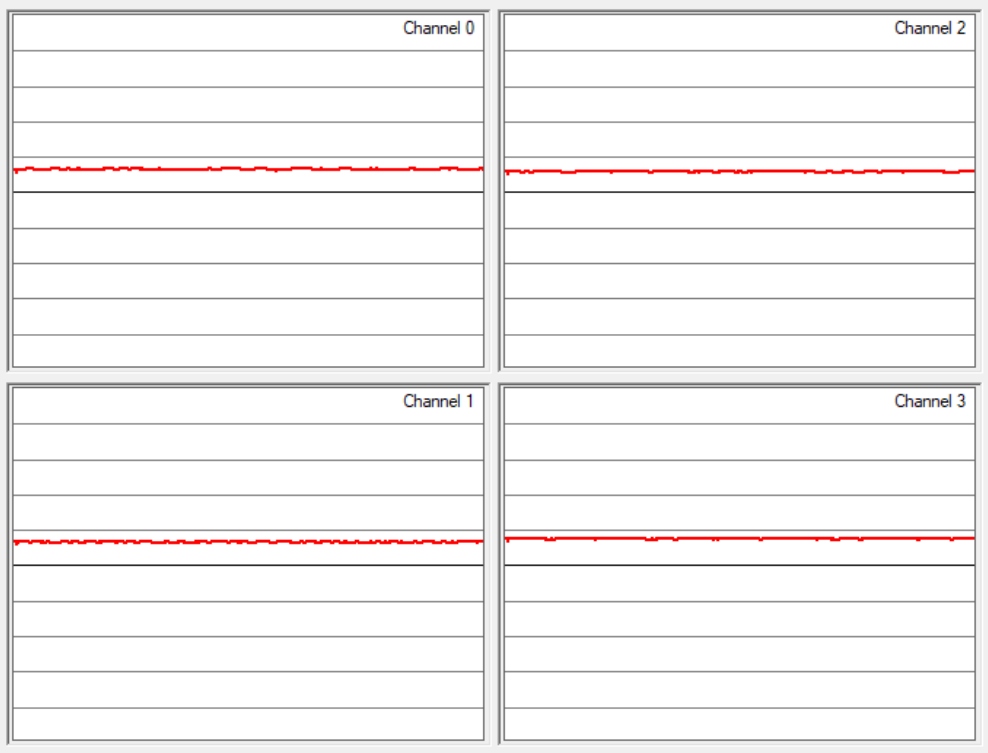

Figure 13: Scope layout - full view

The main window also contains a console which displays detected messages as well as any changes or errors, such as initial start-up mode or conversion to presence sensing.

Figure 14: Window console

7 Navigating the Menus

The main window contains 4 sections: Algorithm, ASIC Control, Wake-Up, and System

7.1 Algorithm Tab

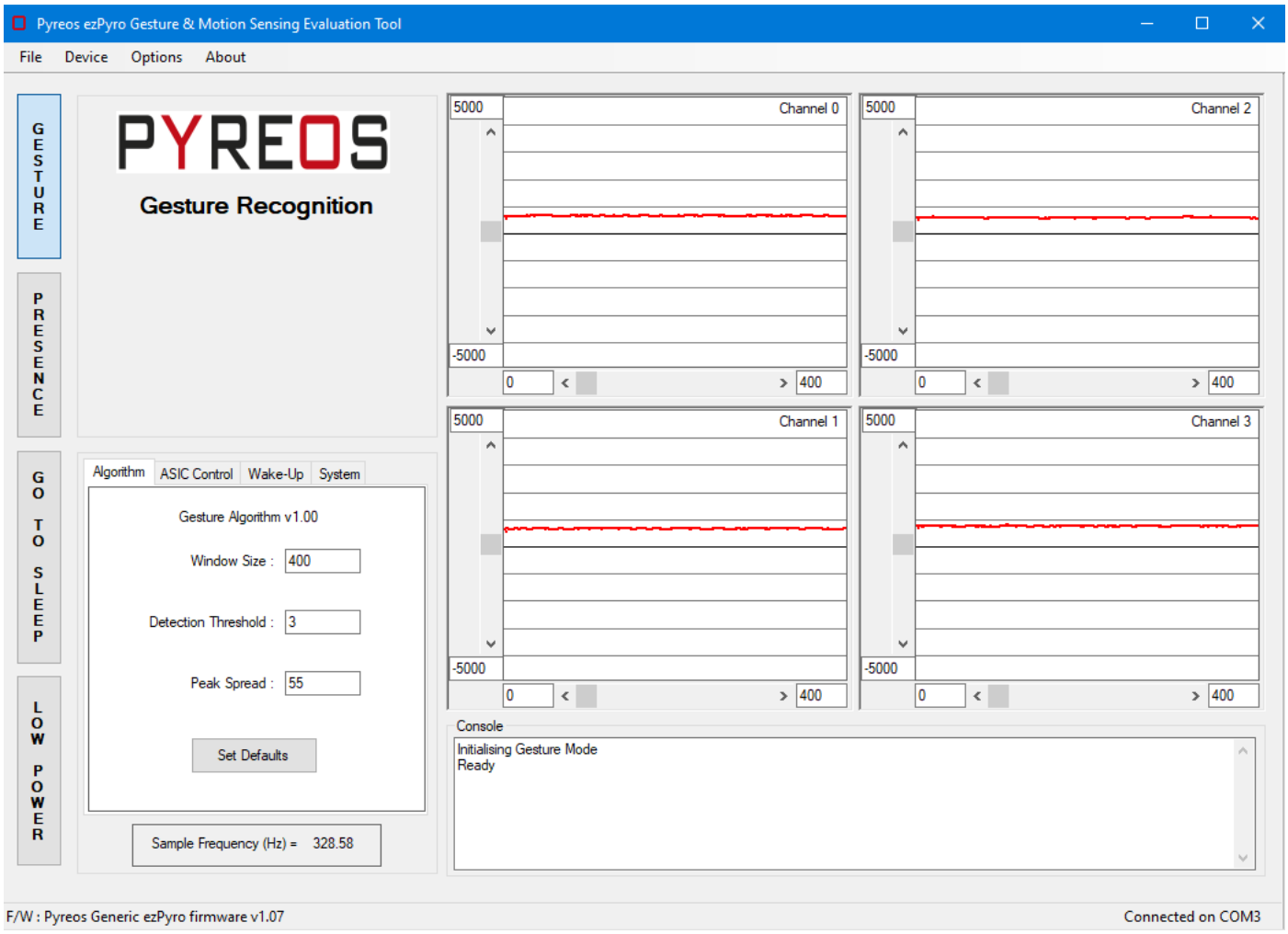

Figure 15: Algorithm tab window

The algorithm tab gives the user access to some basic settings that can be changed.

- **Window Size:** This is window width in samples used to detect event. A larger window width allows slower events to be detected. A smaller window width means that an event is still registered in the scopes, but the direction icon might not activate.
    - Range: 10 to 2000
    - Typical: 400
- **Detection Threshold:** This is how high the peak value must be before the event is recognised as valid.
    - Range: 1 to 20
    - Typical: 3
- **Peak Speed**

Once altered these can be reset to the default values using the Set Defaults button at the bottom of the tab window.

7.2 ASIC Control Tab

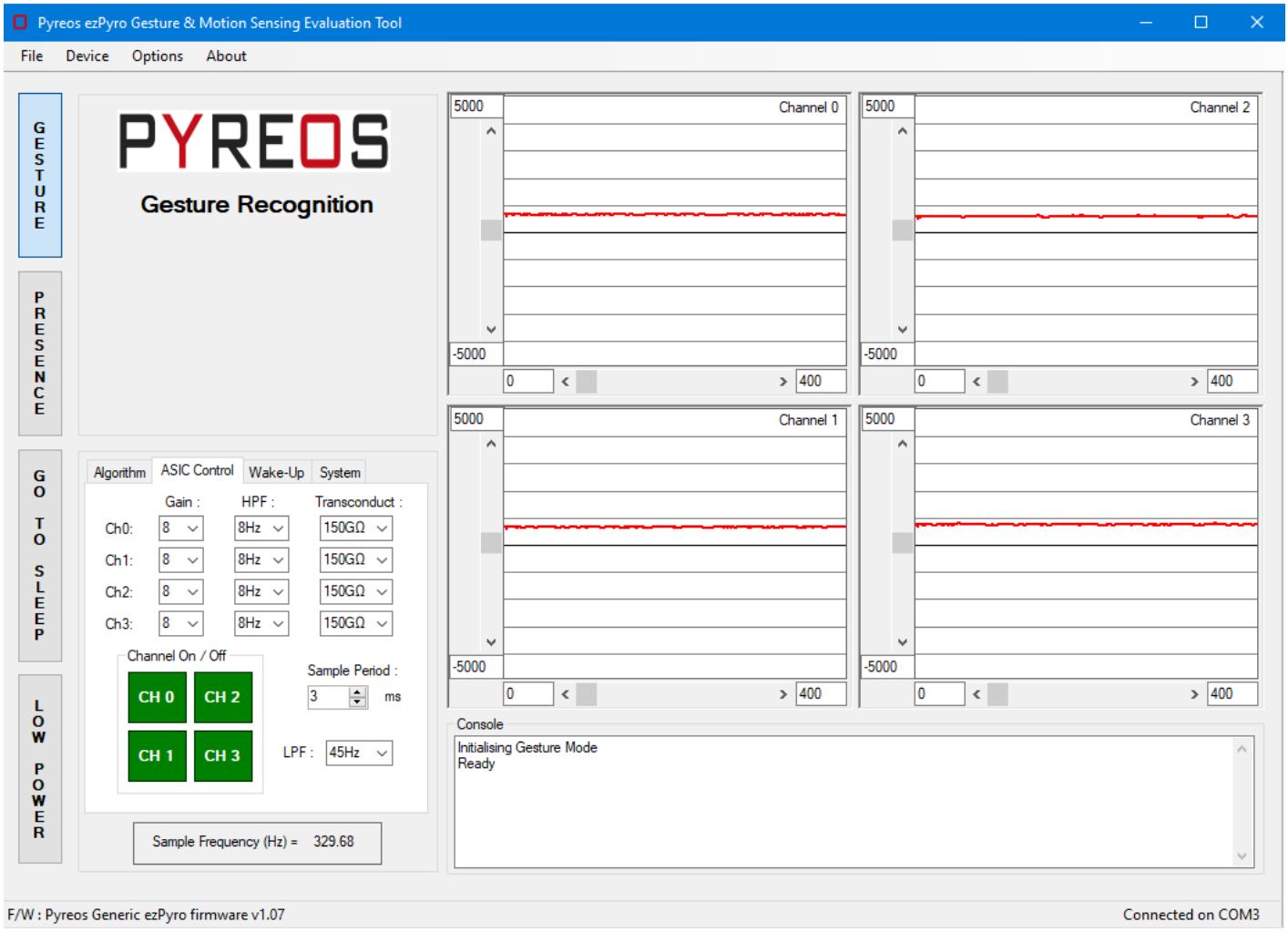

Figure 16: ASIC Control tab window

The ASIC Control tab gives the user access to the various parameters that can be controlled on the output of the ezPyro™.

- **Gain:** The gains should all be set equal on every channel for gesture detection. They can be set independently to allow the user complete control over every aspect of the device that can be set. The gain is set by selecting a capacitor to be used in the charge amplifier within the device.
- **High Pass Filter (HPF):** The high pass filters should again be set equal for gesture detection.
- **Transconductance:** The transconductance gives the user the ability to set the time constant of the sensor and amplifier set-up.
- **Low Pass Filter:** The low pass filter used is common to all channels of the ezPyro™.
- **Sampling Period:** This allows the sampling rate to be altered.

7.3 Wake-up Tab

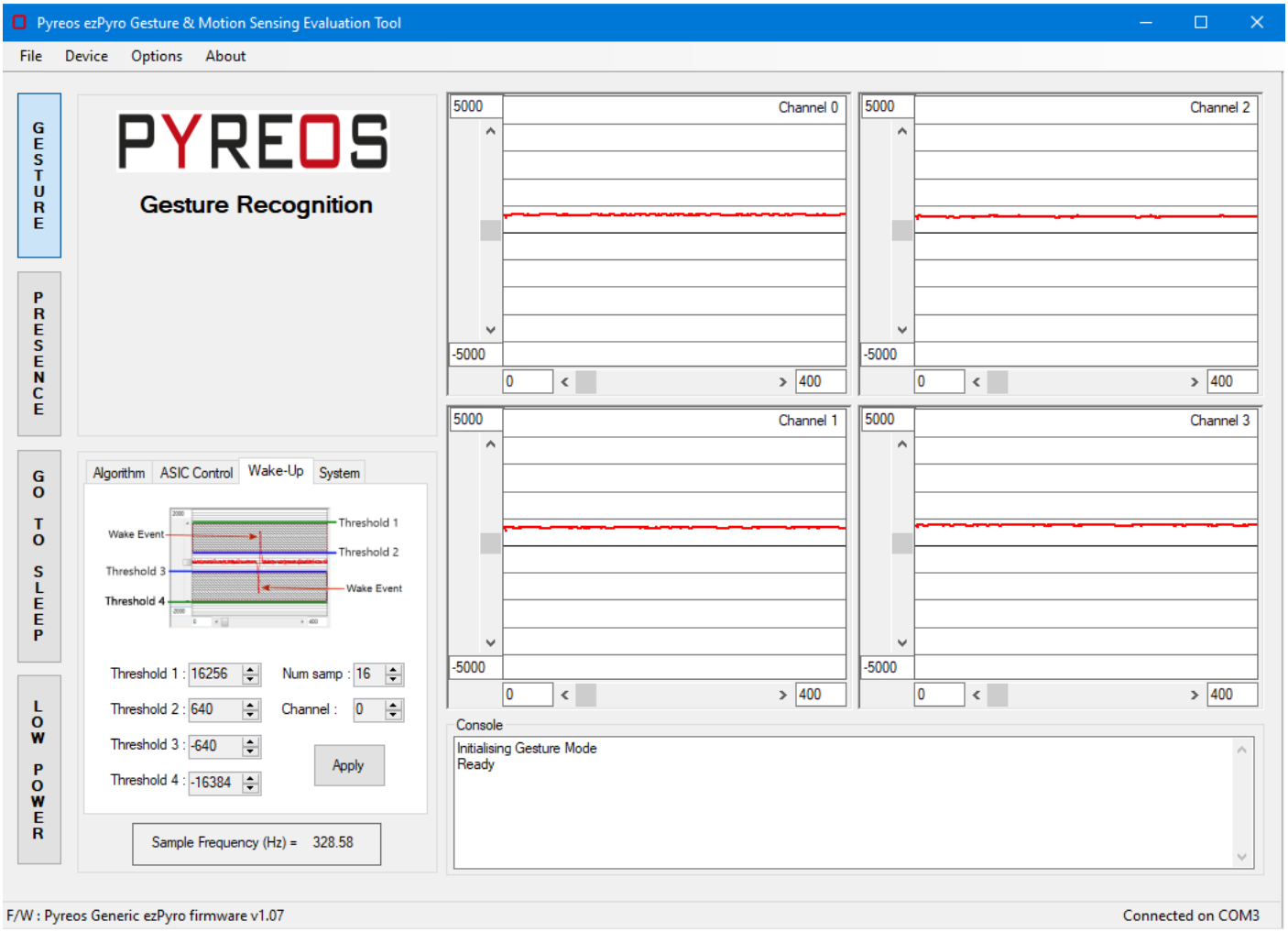

Figure 17: Wake-Up tab window

The Wake-Up tab allows user to access the settings of the wake-up conditions for the device. The wake-up settings only apply when the device is in sleep mode.

- **Thresholds 1-4:** The wake-up works by requiring the signal to be within the range of threshold 1 and 2 or within threshold 3 and 4 for a certain number of samples.
- **Number of Samples:** This can be controlled using the box in the right of Wake-Up tab window.
- **Channel:** This allows the user to select which channel is being used for the wake-up condition.
- **Apply:** Clicking this sets the parameters to the user's settings.

For more detail on wake-up conditions please refer to the ezPyro™ datasheet.

7.4 Go to Sleep

On the left of the main window the 3rd button down (see Figure 18) puts the Evaluation Kit into sleep mode.

When the button is selected the window goes grey and none of the settings can be accessed. This is to ensure that the Evaluation Kit does not use excessive power when not actively in use.

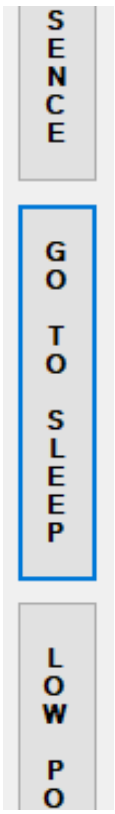

Figure 18: Sleep Mode selection button

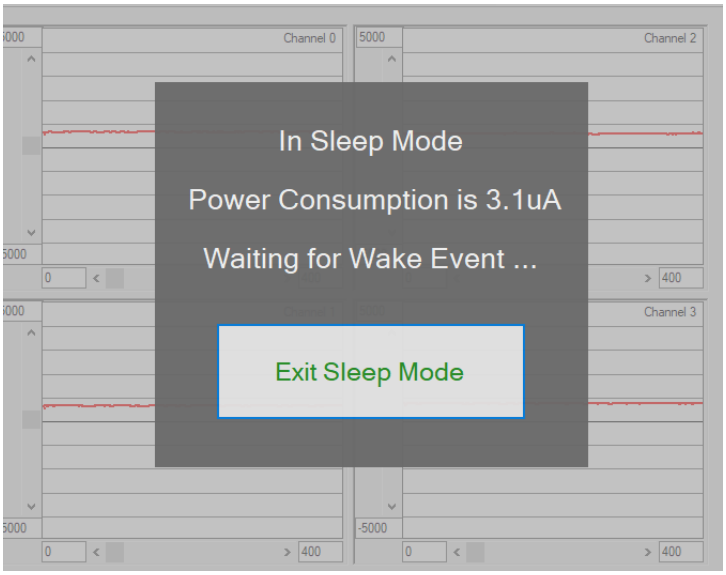

Figure 19: Sleep Mode information box

To wake the Evaluation Kit up an event that meets the wake-up settings needs to occur. If these are set to impossible levels, then the user can click on the Exit Sleep Mode button to wake-up the device and access the settings.

7.5 System Tab

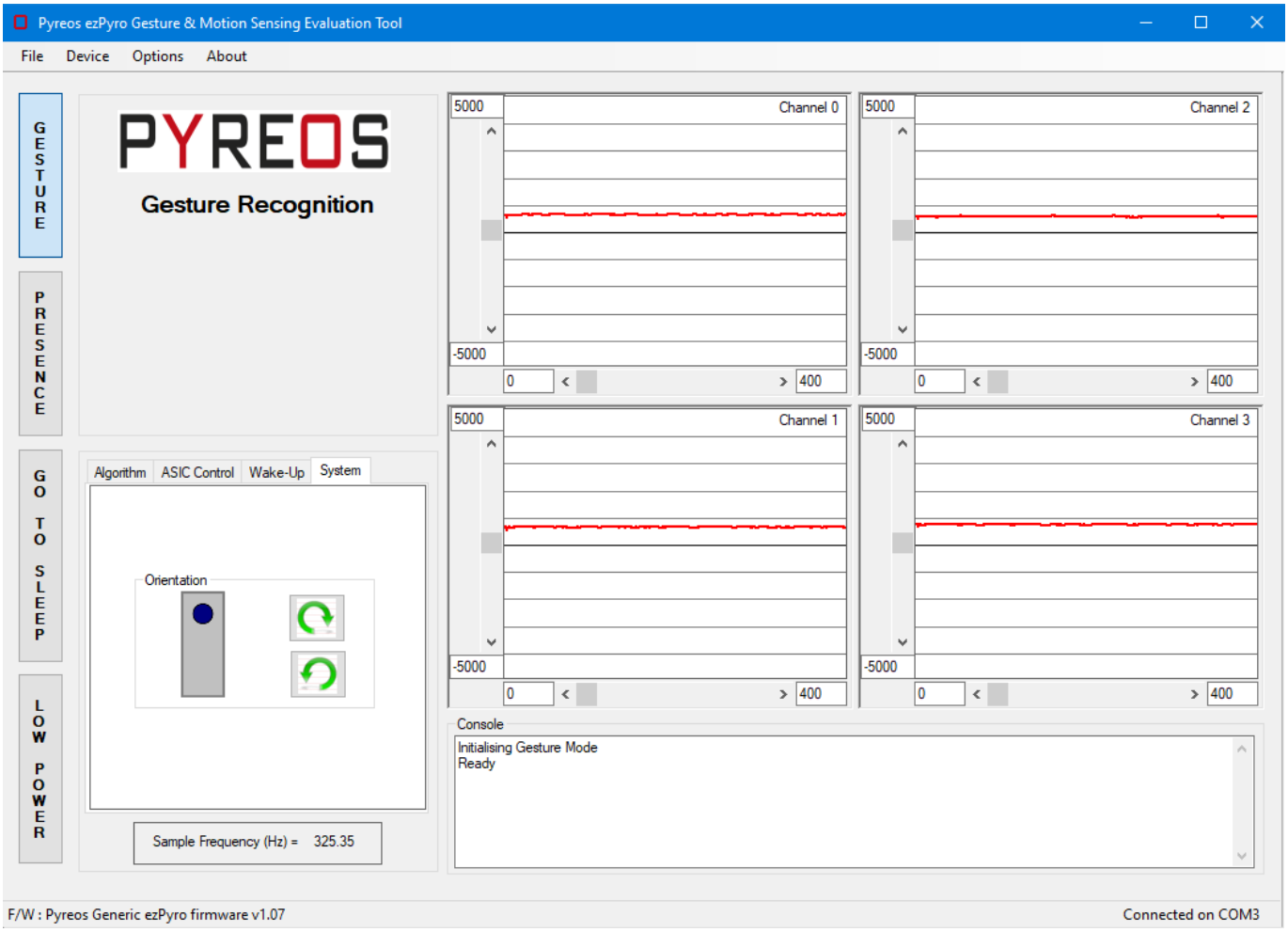

Figure 20: System tab window

The System tab allows the user to set the orientation of the device to ensure directions of events are correctly displayed. The initial settings for the orientation are as shown in Figure 21.

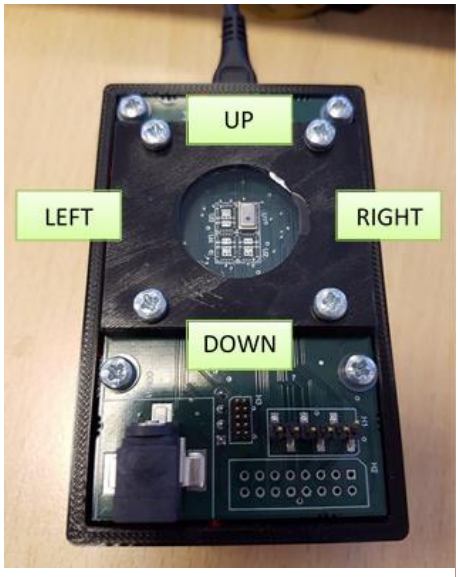

Figure 21: Device orientation

8 Gesture Detection Mode

Figure 22: Gesture Detection

Gestures will produce a distinct signal shape on each channel as shown in Figure 22.

The faster the gesture, the closer together the peaks in the signals are. If the signal peaks are small (can be caused by the hand temperature being close to background temperature), it is recommended to reduce the sensitivity in the settings window as will be described later.

8.1 Gesture Trigger Threshold option

Setting the threshold for gestures to be lower will cause a greater chance of false gestures being registered caused by noise. And setting too high will make registering actual gestures less likely.

8.2 Gesture Detection Algorithm Peak Spread

This value determines how far apart the peaks in signals can be before considered a gesture. The larger the value used, the more the system is affected by noise.

9 Presence Recognition Mode

A presence event is one that simply states that an object of higher temperature than the background radiation has come into or moved out of the FOV of the sensor.

The main window in both versions of Presence Recognition consists of one scope as only one pixel is required to sense a change in temperature within the sensor's FOV with no regard for direction.

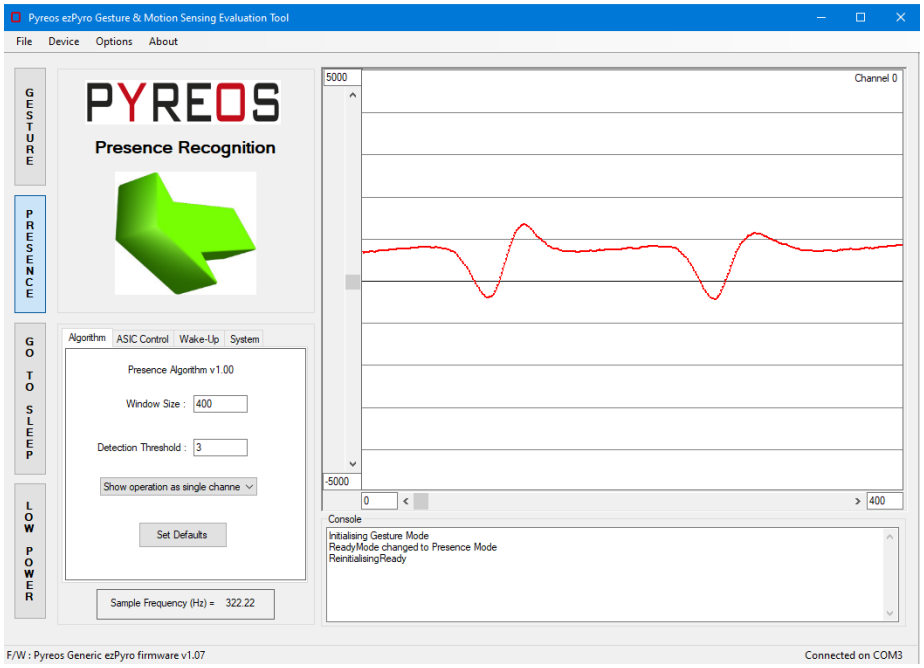

Figure 23: Presence Recognition – dPYEGE01. dPYEGE02

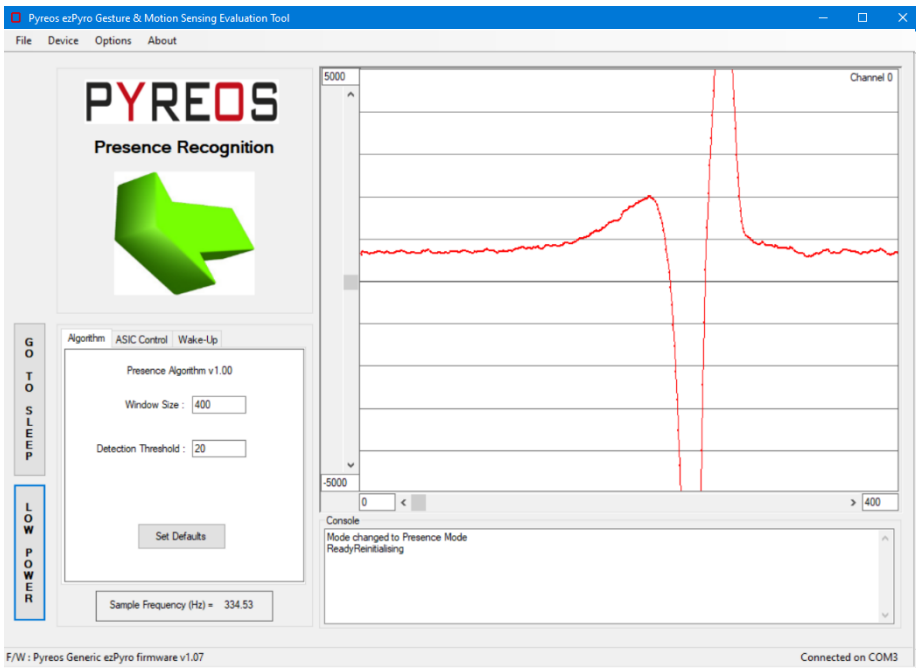

Figure 24: Presence Recognition - dPYEMO01

9.1 The Main Menus

The same ASIC, Wake-Up and System settings are available when using presence recognition or a dPYEMO01 Evaluation Kit.

The Algorithm tab is slightly different It is possible to modify the presence recognition algorithm parameters. When a dPYEMO01 Evaluation Kit is connected, then only window size and detection threshold parameters are offered. When Presence Recognition mode is used with the other kits then there is also the option to show a single scope or to show all four scopes. In both instances the peak spread parameter is not available.

9.2 Presence Algorithm

The algorithm used for a presence being detected is an analysis of the rate of change of the signal. A group of 3 data points are averaged and then the following 3 data points averaged. The averaging reduces the effect of noise on the algorithm, more data points could be used to improve resistance to noise but that would be dependent on the location of the device in the end application.

These two averaged values are then used to determine the rate of change of signal by differentiating with respect to time, or the spacing between data points which in this case is three.

The detection threshold affects the required rate of change of signal to give a positive motion detection event. The initial value of 20 give good results but again this can be adjusted depending on the applications environment and optical setups that might be in use.

10 Power Mode

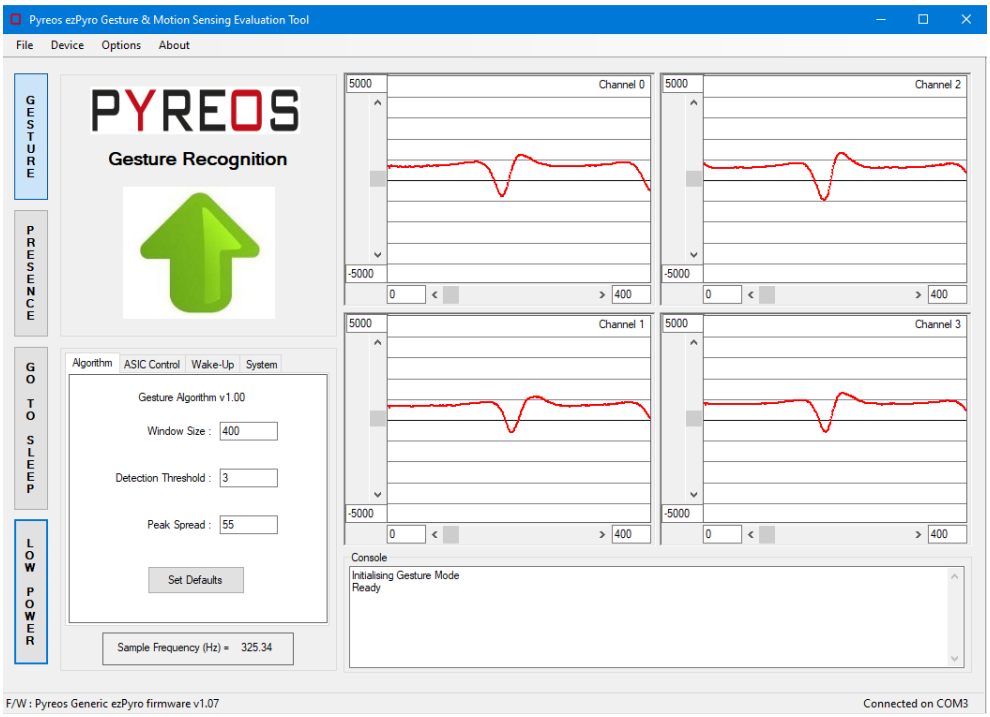

Figure 25: Low Power Mode

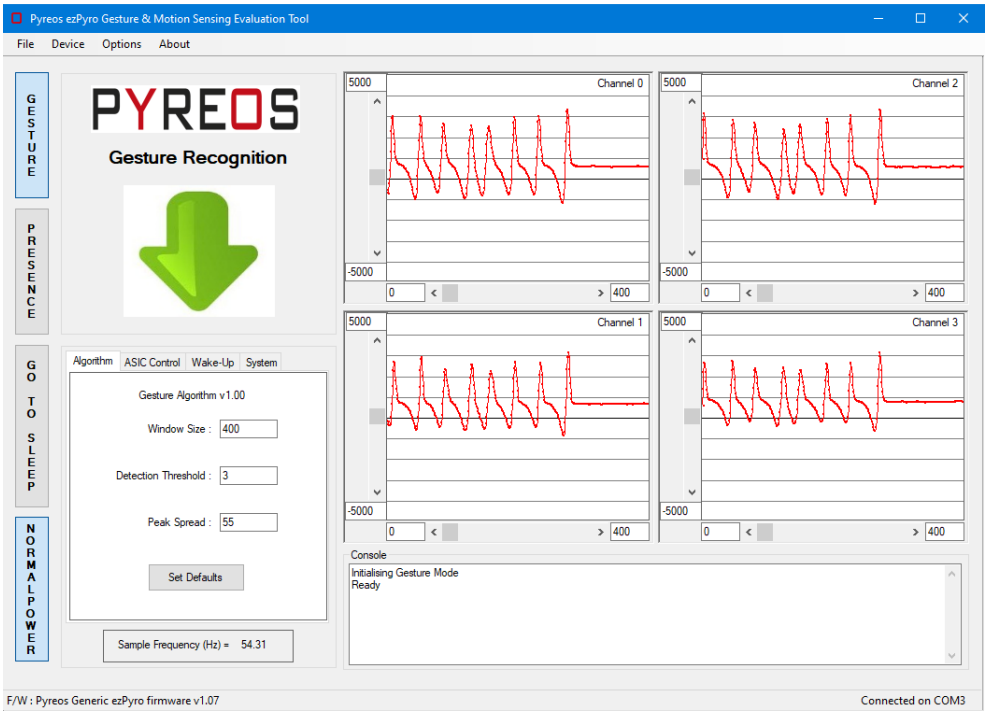

Figure 26: Normal Power Mode

There are two power modes available. By default, the software runs in low power mode. This offers a faster sampling rate and a smoother response from the sensor. In normal power mode the sampling rate is around 6 time slower and the response from the sensor is noisier.

11 Saving Data to CSV file

To save data, select **Save to CSV** from the *File* menu.

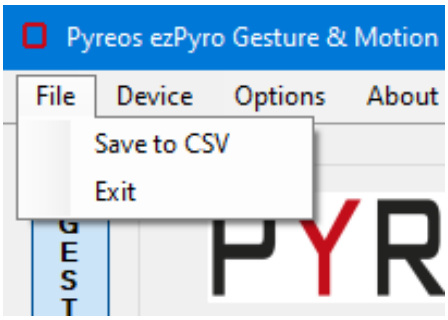

Figure 27: File Menu

The *Capture Data to CSV File* dialog box is displayed.

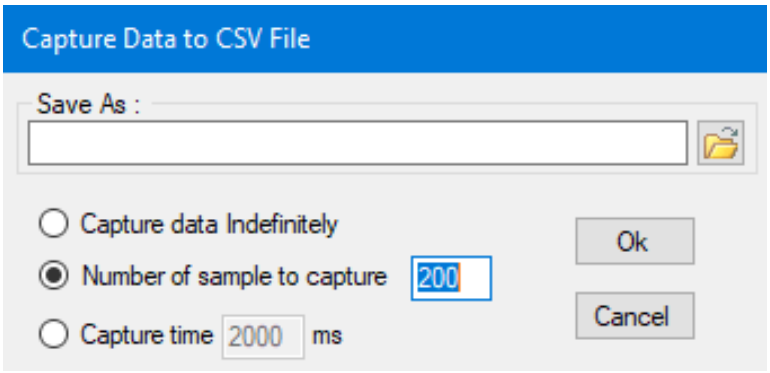

Figure 28: Save to CSV dialogue box

Enter the full address path to which the file should be written or browse to the required folder. By default, files are saved to the *Pyreos* folder if it exists or *Documents* if it does not. The *Pyreos* folder is created automatically in the Documents folder the first time the user saves a configuration file.

Choose options for the way data is to be captured. The options are to:

- **Capture data indefinitely**: save data for an undetermined length of time.
- **Number of samples to capture**: save a specific number of samples according to the sampling rate set in CSV File Options.
- **Capture time xxxx ms**: record data for a set time interval (in milliseconds).

12 About

Click on **About** in the menu bar to display file and version information about the ezPyro™ Gesture & Motion Sensing Evaluation Tool software.

Figure 29: About dialogue box

13 Troubleshooting

13.1 No Kit Detected on the COM Ports

If no kit is detected on the COM port –

- Try rescanning the ports using the Rescan Ports options in the Devices dropdown menu.
- Try disconnecting the USB cable from the device and the PC and then reconnecting everything.
- Try disconnecting the USB cable from the device and the PC, close the Pyreos software. Reconnect the USB cable to the device and the PC and reopen the Pyreos software.

13.2 Signal Saturation

13.2.1 Continuous Saturation

If the signal remains saturated use the CCP and AFE register cogs to alter the gain, high pass filter, low pass filter, sample rate, and feedback trans. to the required levels so that the system gives clear, stable readings

13.2.2 Sporadic Saturation

If the readings are stable but suddenly saturate and then stabilise again, ensure that the environment around the kit is stable. Limit changes in temperature caused by air flow; drafts, air conditioning, etc. and sunlight.

13.3 I/O Exception

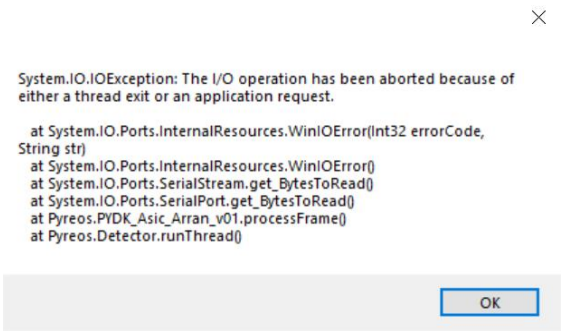

Figure 30: I/O Exception

If this warning appears check that the USB cable is undamaged and that it is connected properly.

A timeout warning also appears and the kit needs to be reconnected in the usual manner.

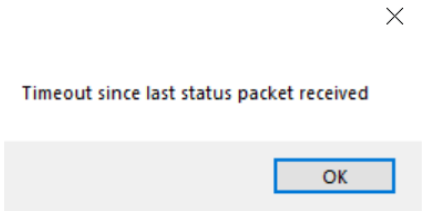

Figure 31: Timeout Warning

If the problem persists replace the USB cable, ensuring that it can handle the transfer of both power and data.

14 Further Information and Support

The Pyreos website has a list resources available to help our customers

https://pyreos.com/resource-centre

If you encounter any difficulties with the kit, please contact Pyreos Support

E-mail: support@pyreos.com