KEMET
a YAGEO company

# SMD Pyroelectric Infrared Gesture and Motion Evaluation Kits
## USEQMSKS221600
## USEQMSK1220900
## USEQMSKL011600
## USEQMSKL221600

## for low cost, low power, non-contact mid IR motion/presence and gesture detection

## User Guide
## Rev. 1.5

### APR 2022

## TABLE OF CONTENTS

# 1    INTRODUCTION

This user guide describes the different KEMET Gesture and Motion Evaluation Kits for SMD mid IR gesture and motion sensors. This document covers all the 4 variants of the kits: mid-range and long-range gesture and mid-range and long-range motion.

# 2    GETTING STARTED

*USEQMSKS221600*                                    *USEQMSK1220900*

*USEQMSKL011600*                                    *USEQMSKL221600*

*Figure 1 – SMD Gesture and Motion Kits USEQMSK_____00*

## 2.1    Kit Contents

1. SMD Long Range Gesture Sensing Kit USEQMSKS221600, including sensor USEQMSEA221680 2x2 5.0 μm LWP (large aperture), with Fresnel lens

or    SMD Medium Range Gesture Sensing Kit USEQMSK1220900, including sensor USEQMSEA220980 2x2 5.0 μm LWP (small aperture), no optics

or    SMD Motion Sensing Kit USEQMSKL011600, including sensor USEQMSEA011680 1px 5.0 μm LWP, with Fresnel lens

or    SMD Directional Motion Sensing Kit USEQMSKL221600, including sensor USEQMSEA221680 2x2 5.0 μm LWP, with Fresnel lens

2. Micro USB to USB cable
3. KEMET Gesture & Motion Sensing Evaluation Tool (Digital) software
   click here for downloading the software

## 2.2    Minimum System Requirements

1. Microsoft® Windows PC
2. 2 GB of RAM
3. 450 MB of available hard-disk space for installation, additional free space required for storing CSV files
4. 1,024x768 display (1,280x1,024 recommended)
5. Local administrative rights to install device drivers
6. .NET framework 4.5
7. 1 free USB port

# 3    INSTALLATION

## 3.1    Installing the KEMET Gesture & Motion Sensing Evaluation Tool Software

From the software pack available to download here, run the **setup.exe** file that has this icon. This will start the installation process.
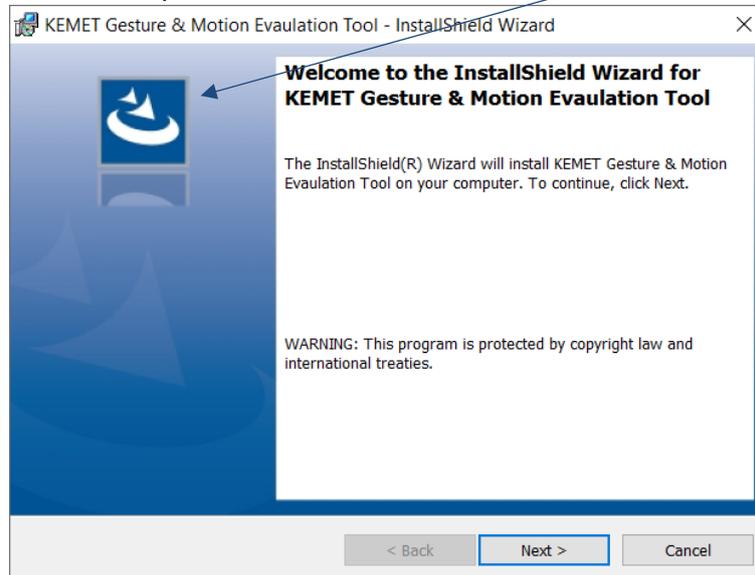


*Figure 2 – Installer Screen*

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.

## 3.2    Installing the ST Microcontroller USB Driver

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

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

Once connected the green light on the SMD 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).

## 3.3    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.

## 3.4    Connecting the SMD Gesture and Motion Sensing Evaluation 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.

## 4    SOFTWARE USER GUIDE

## 4.1    Starting the Software

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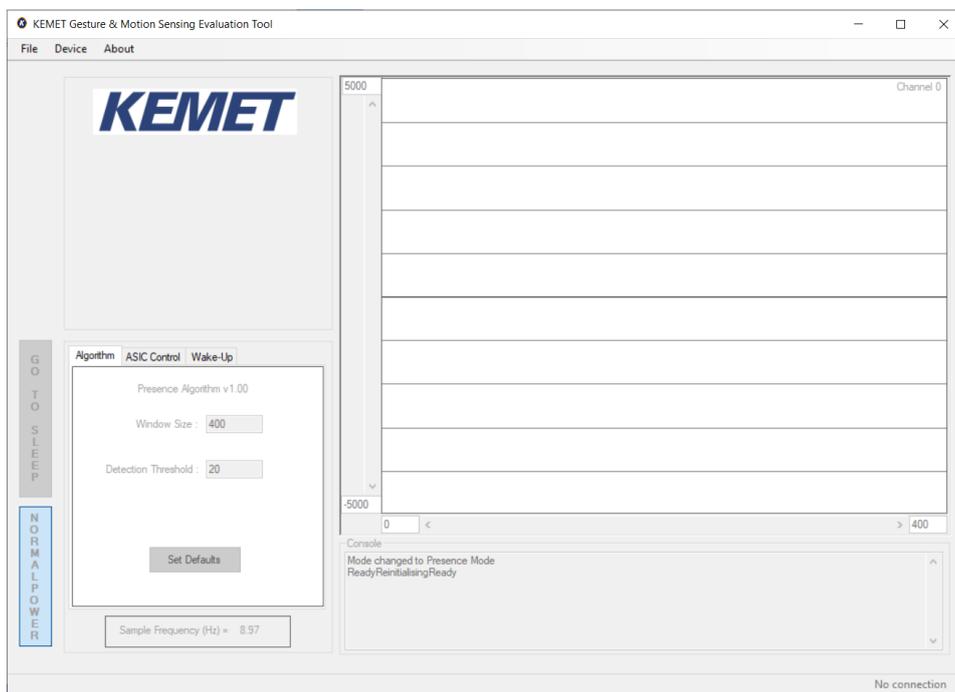


*Figure 3 - Software Main Page*

## 4.2    Connecting Software to the Demo Kit

To connect to the demo kit, select **Device** and then **Connect to Device**.
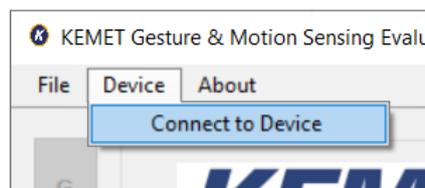


*Figure 2 – Device Connection*

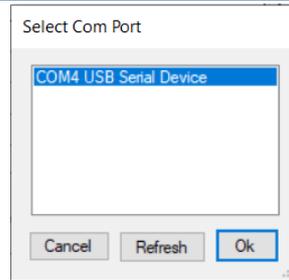This will open a window with all available devices on COM ports.

*Figure 3 – Com Port Selection*

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. Whilst the calibration sequence is running, 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.

## 4.3    Different Variations

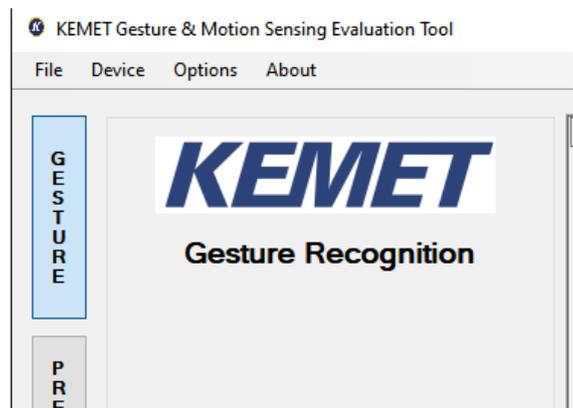The software will automatically determine the type of kit when it is plugged in.



*Figure 6 – USEQMSKS221600 and USEQMSK1220900 Gesture Sensing Kits*
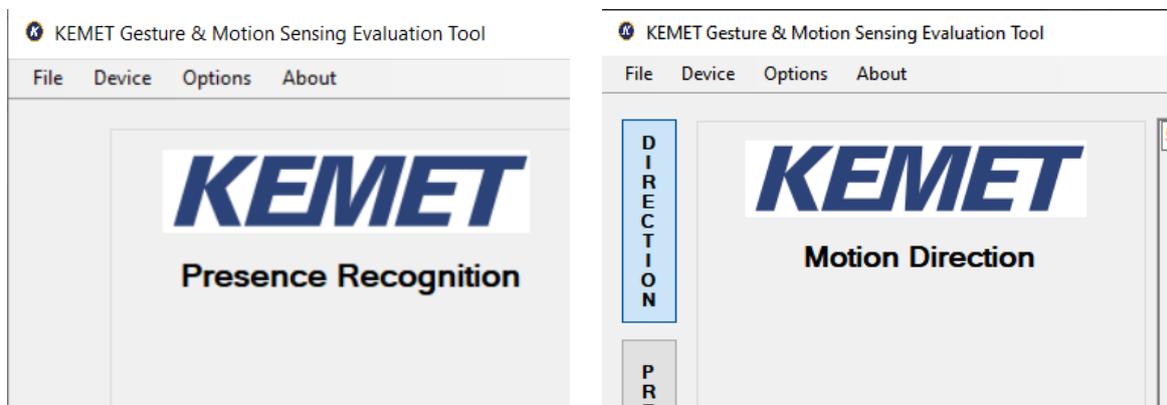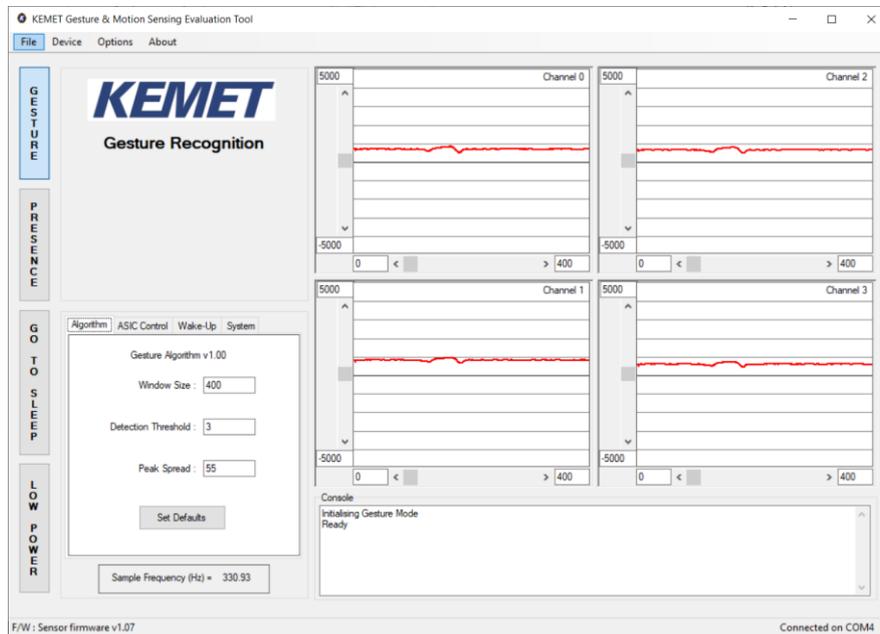


*Figure 7 – USEQMSKL011600 Motion Sensing Kit*

*Figure 8 – USEQMSKL221600 Directional Motion Sensing Kit*

## 4.4    Navigating the Menus

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

### 4.4.1   Algorithm Tab



- The window showing current detection mode (the button for the active mode, gesture or presence is highlighted in blue). When an event occurs, the detected event will be shown with a direction icon.
- 4 scope windows which show the signals produced by each of the pixels in the sensor.
- A console which displays detected messages as well as any changes or errors and a simple setting window where the trigger threshold can be changed.

See below for use of parameters.

### 4.4.2   ASIC Control Tab
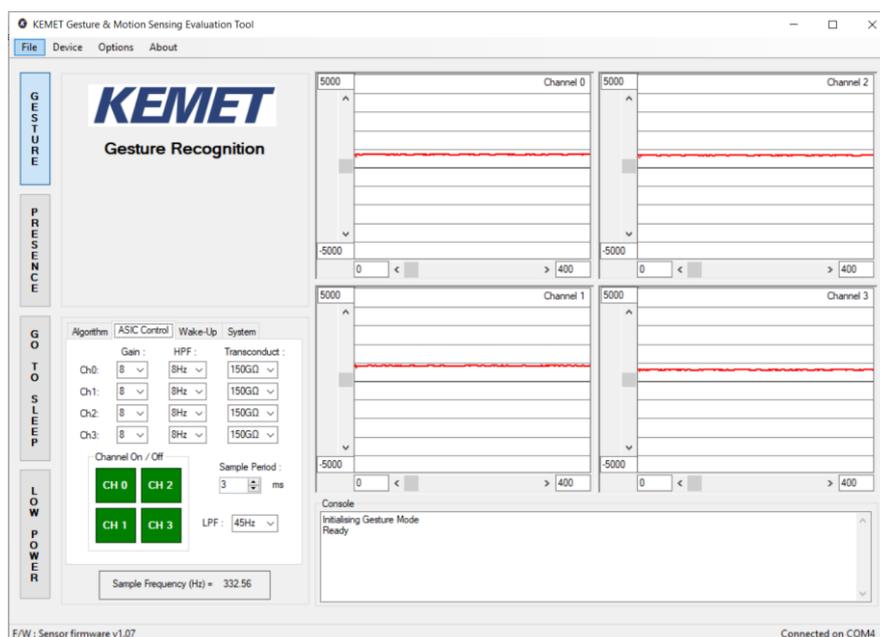
The **ASIC** box gives the user access to the various parameters that can be controlled on the output of the SMD USEQ*S sensor.

- **Gain:** The gains should all be set equal on every channel for gesture detection. They are allowed to be set independently simply 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.
- **HPF:** The high pass filters should again be set equal for gesture detection.
- **Transconduct:** The transconductance gives the user the ability to set the time constant of the sensor and amplifier set-up.
- **LPF:** The low pass filter used is common to all channels of the SMD USEQ*S sensor.
- **Sampling Period:** This allows the sampling rate to be altered.

## 4.4.3 Wake-Up Tab
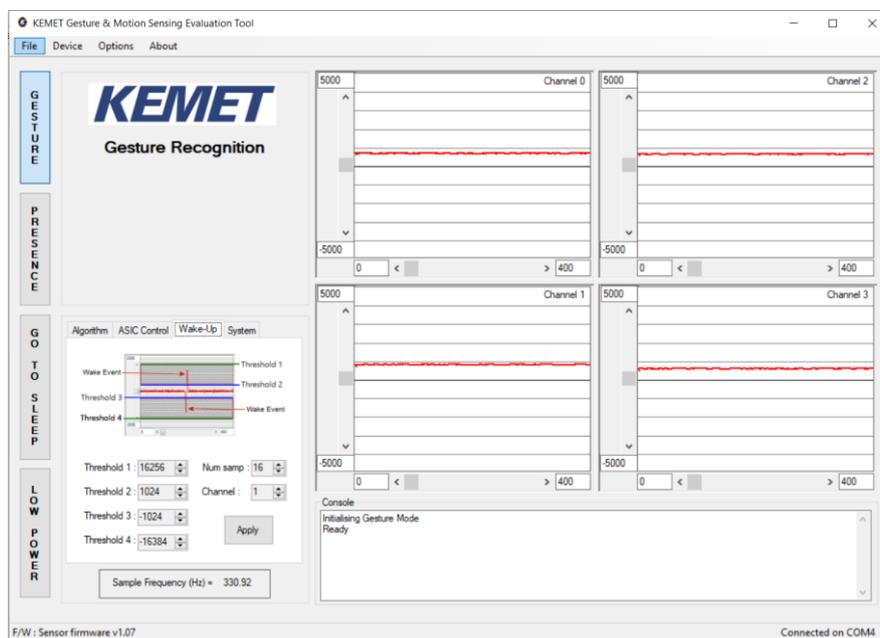


The **Wake-Up** box allows the setting of the wake-up conditions for the device. The wake-up only applies when the device is in sleep mode.

- 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.
- The number of samples required is in the top right box.
- The channel that is being used for the wake-up condition is selected in the box above the **Apply** button.

For more detail on wake-up conditions please refer to the KEMET *Sensor Evaluation Tool Software User Manual*.
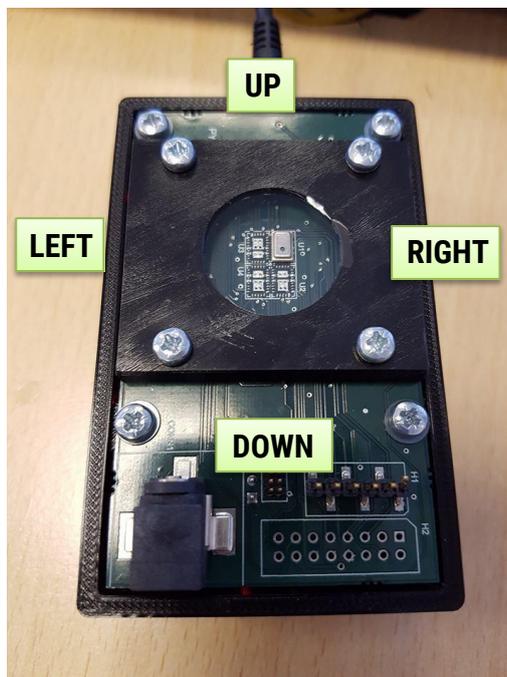
## 4.4.4 System Tab
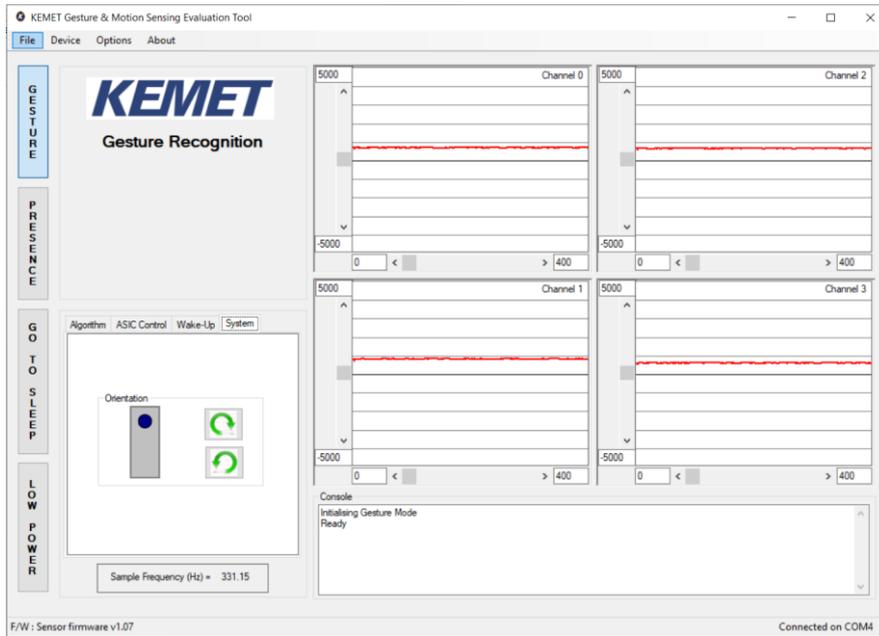


The **System** box allows the user to set the orientation of the device to ensure directions of gesture are correctly displayed.
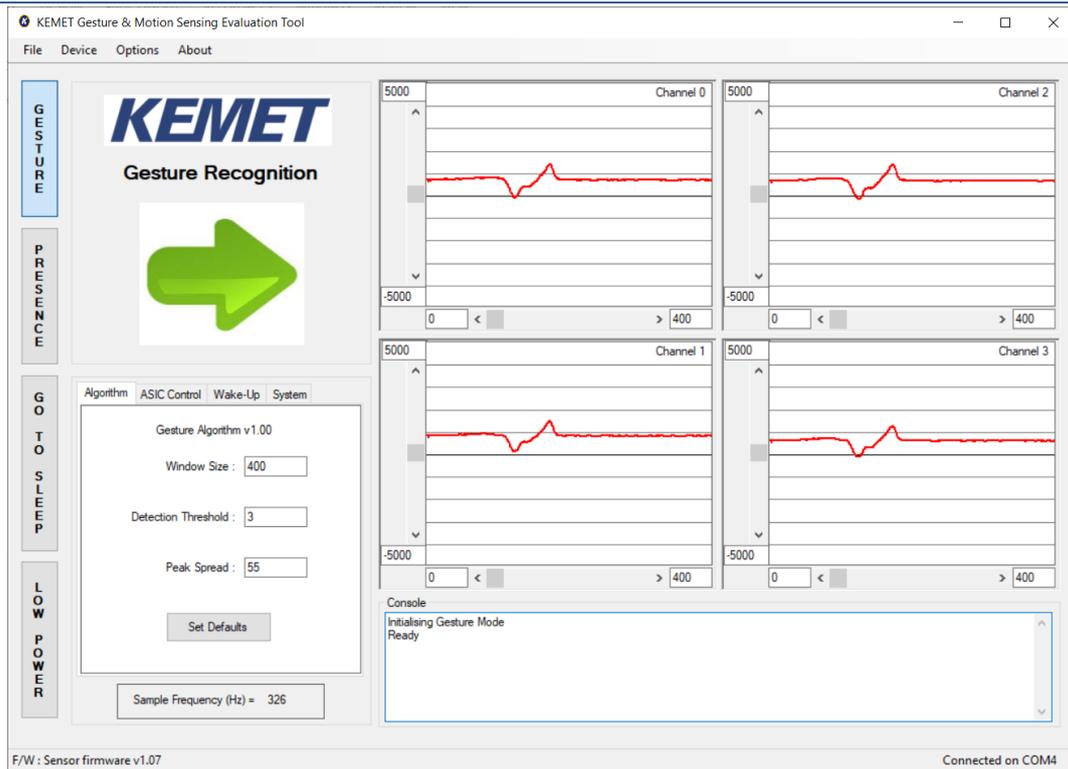
# 5    GESTURE DETECTION MODE

## 5.1    General Gesture Detection

The initial settings for the orientation are as shown below.



The gestures will produce a distinct signal shape on each channel as can be seen below.

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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.

## 5.2    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.

## 5.3    Gesture Detection Algorithm Peak Spread

- 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.
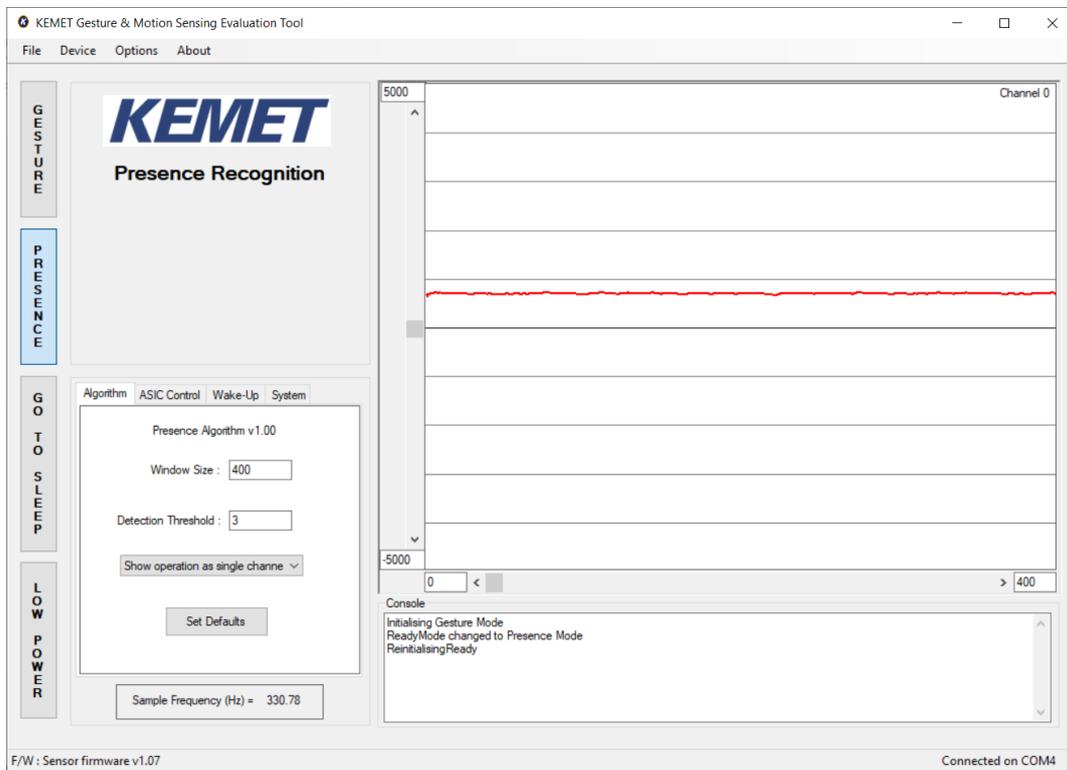- **Range:** 1 to 400
- **Typical:** 12

## 6    PRESENCE DETECTION 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.
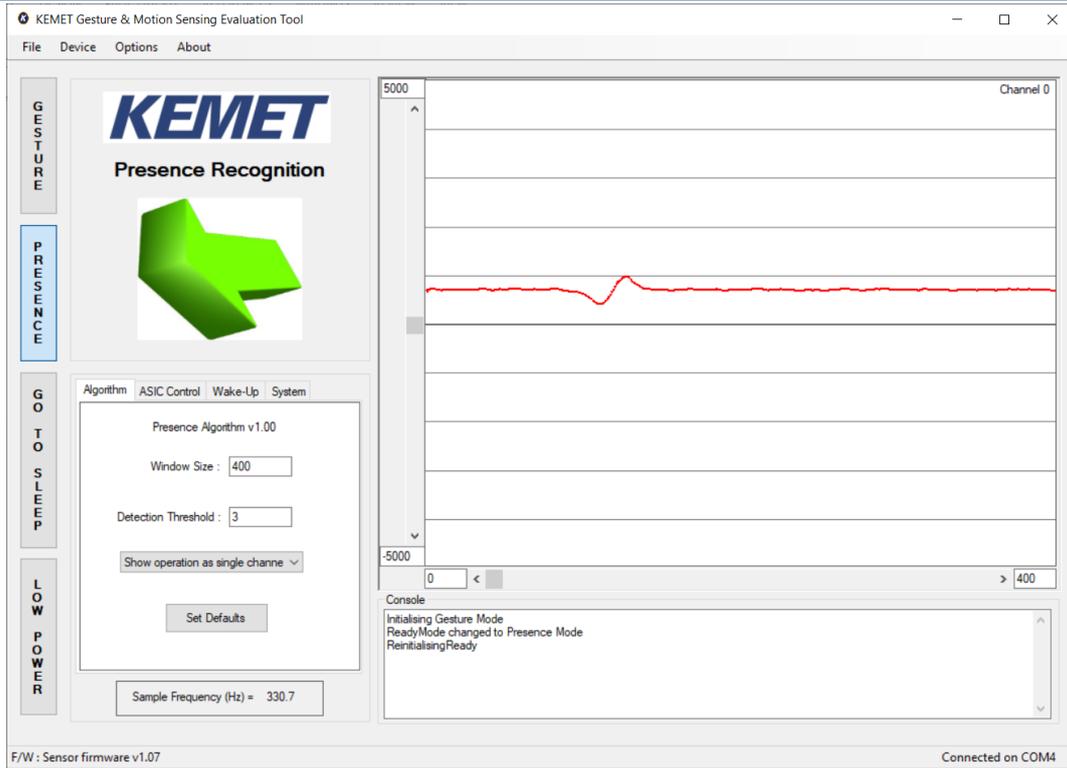
## 6.1 Proximity Detection Algorithm Parameters

It is possible to modify the proximity detection algorithm parameters.

**Window Size**

- Window width in samples used to detect event.
  Larger window allow slower gestures, smaller rejects them.
- **Range:** 10 to 2,000
- **Typical:** 400

**Detection Threshold**

- How high the peak value has to be before recognised for gesture.
- **Range:** 1 to 20
- **Typical:** 3

The same ASIC, Wake-Up and System settings are available within the presence section as in the gesture detection section.

## 6.2 Proximity 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 application's environment and optical setups that might be in use.