Sensor Evaluation Tool

Software User Manual

Rev. 2.3

MAR 2022

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1 INTRODUCTION

This document covers the operation of the Sensor Evaluation Tool software and should be used in conjunction with the *SMD Sensor Reference Manual*.

The software can be used to test up to four single-pixel sensors or one 2x2 array sensor. It enables you to optimise the sensor for a particular environment, observe signals in real time and to experiment with register settings, optimising:

- gain
- filtering (HPF, LPF, transconductance)
- sample rate
- clk/sync for device synchronisation
- interrupt enable / disable
- wake up (WUP)

Register settings can be saved to, and loaded from, a text file. Please refer to Section 7 for details.

2 GETTING STARTED

2.1 Installing the Sensor Evaluation Tool

Download the latest Sensor Evaluation Tool here. Then run the setup application. The software is compatible with Windows 7, 8, 10.

2.2 Launching the Software

1. Open the Sensor Evaluation Tool from the **Start** menu of the connected computer. By default the software launches in the 4 sensor single-pixel view. If a device has been connected before launching the software, go to step 4.

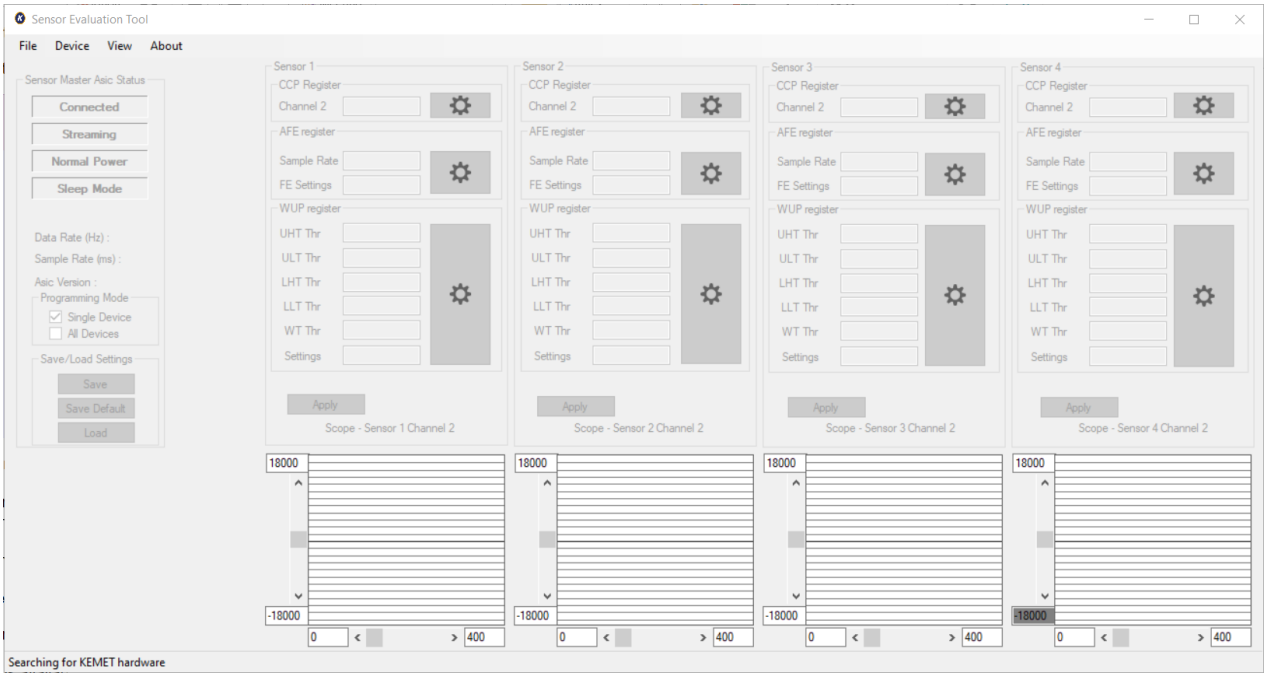

Figure 1 – Multiple Single-Pixel Sensor View (Default) without a Connected Device

2. Connect the device to the PC.
3. Select **Rescan Ports** from the **Device** menu.

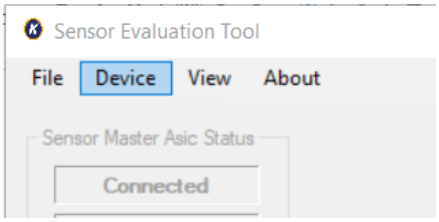

Figure 2 – Rescan Ports

4. The name of the device appears in the **Device** menu. Click on the device to complete the connection.

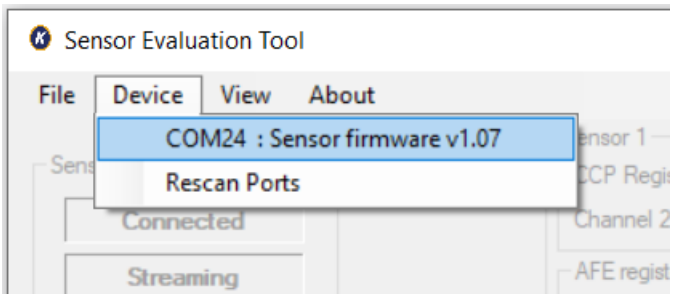

Figure 3 – Connected to Device

5. A warning message “Master device has no channels enabled” is displayed.[1] This implies no data will be streaming as the **clk** and **sync** outputs of the master will be inactive when no data is being recorded. No data will be streamed until the channels have been enabled on the master (by default, Sensor 1 is the master, but this can be changed in the AFE register settings).[2]

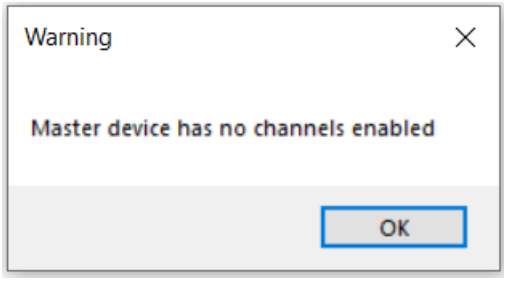

Figure 4 – Device Connected - No Channels Active

6. Click on the **OK** button.

[1] This message is not displayed if the sensors have been used previously or if a default configuration file exists.
[2] There can only be one master device for surface mounted devices. If there is more than one master then the slaves receive multiple clock and sync signals and this causes interference in the slave output resulting in a noisy signal.

3 4-SENSOR SINGLE-PIXEL VIEW

With four sensors connected to the backplane board the following window is displayed.

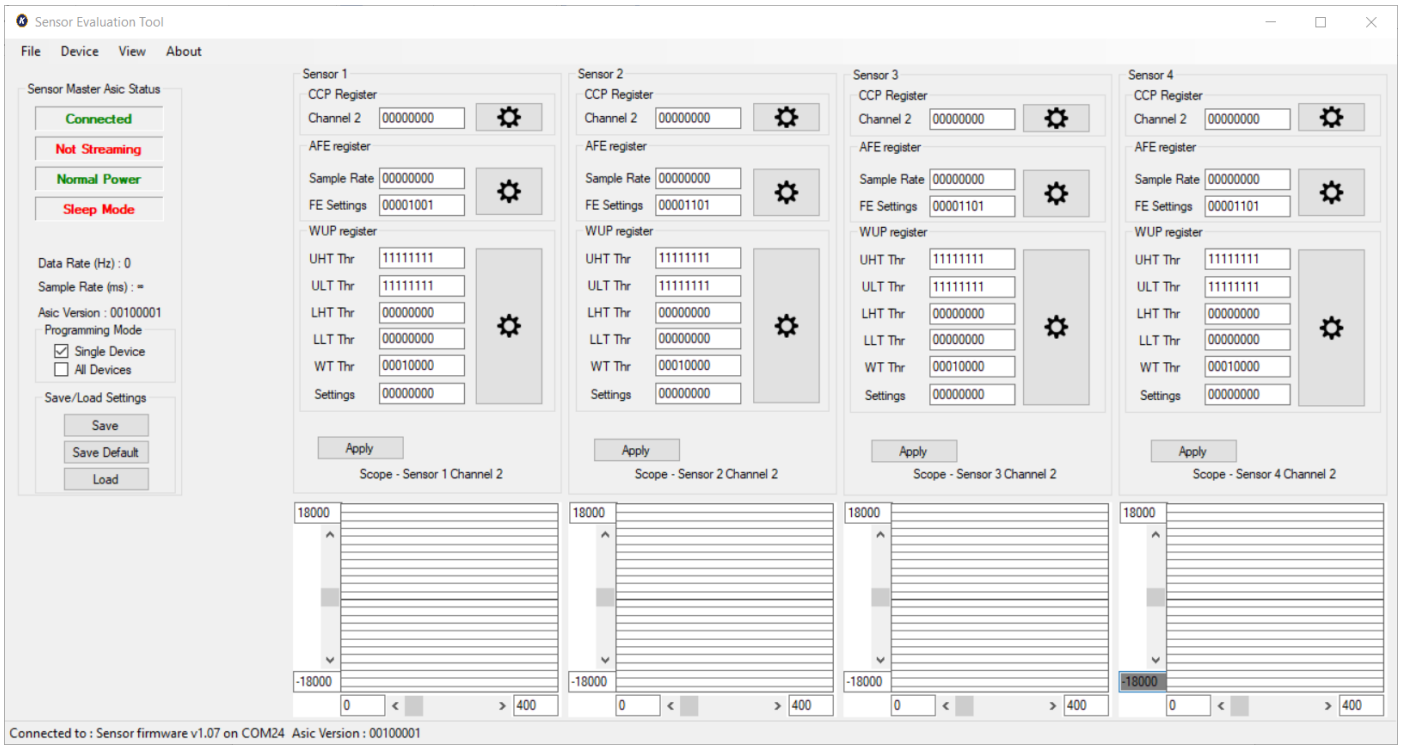

Figure 5 – Sensor Evaluation Tool Window Before Sensors Have Been Enabled

1. Input values as required into the **CCP Register** for the sensor.[3]

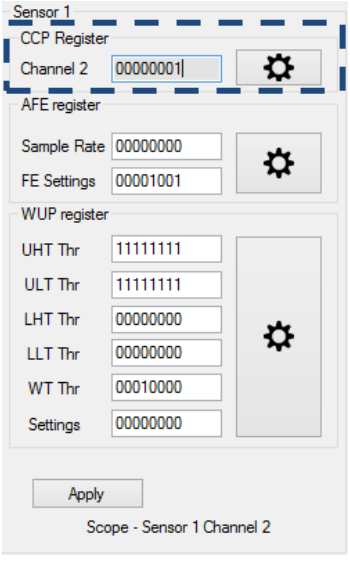

Figure 6 – Changing CCP Register Settings Directly

[3] These textboxes represent the bits of the registers. The input must be zeroes and ones (binary characters) and will be interpreted as a byte regardless of how many characters have been input. For example, 111 is interpreted as 00000111. Entries are treated as the least significant bits of the whole byte.
When changing registers directly please refer to the *SMD Sensor Reference Manual*; this explains the meaning of each bit in the registers. Any change to a register setting is not implemented until the **Apply** button has been clicked. If a new setting has not been applied it is shaded grey, as shown in Figure 6.

2. Click on the **Apply** button for the sensor. Check that a signal is displayed.

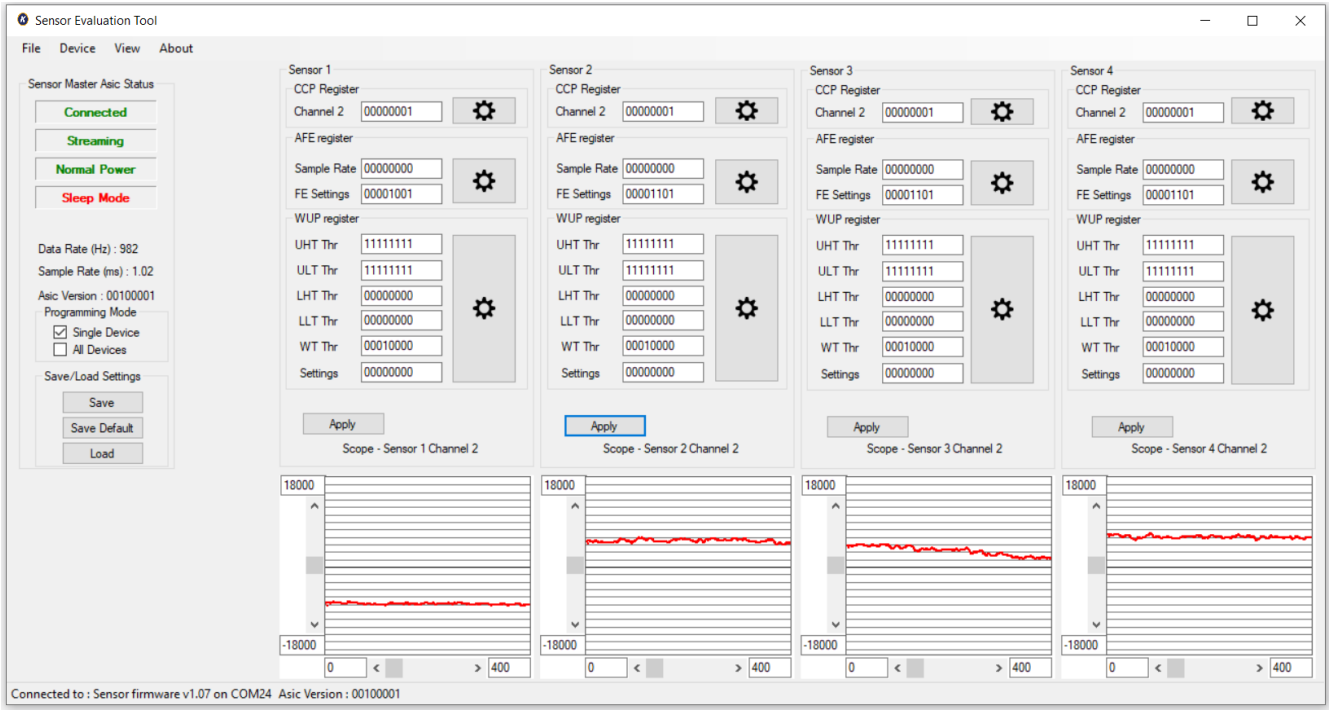

Figure 7 – Changing CCP Register Settings Directly - No Saturation

3.1 Sensor Configuration Settings

For more detailed information about the CCP, AFE or WUP settings, click on the cogs adjacent to the register settings. Changes are not implemented until the **Apply** button has been clicked. If a modified text field has not been applied, the box is shaded grey.[4]

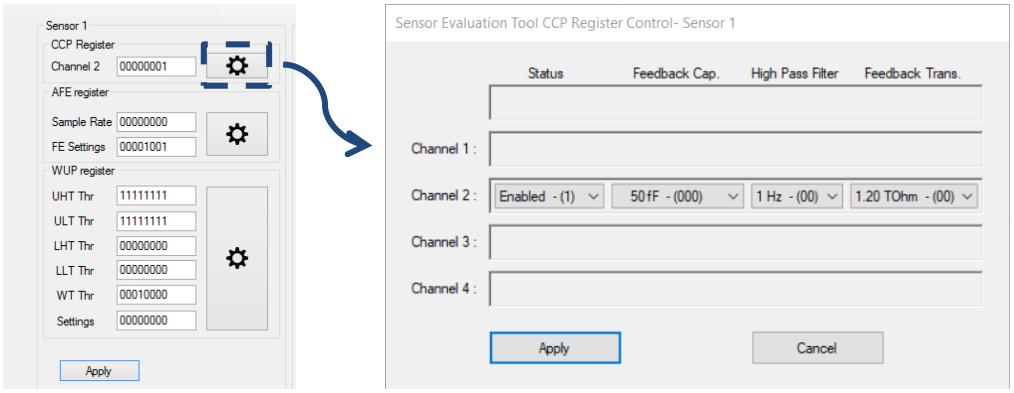

Figure 8 – CCP Cog Single-Pixel Sensor View Sensor 1

[4] Please refer to the **SMD Sensor Reference Manual** for information about these registers and their settings.

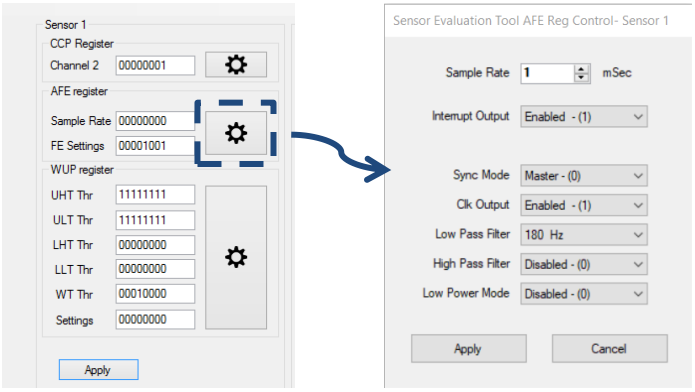

Figure 9 – AFE Cog Single-Pixel Sensor View Sensor 1

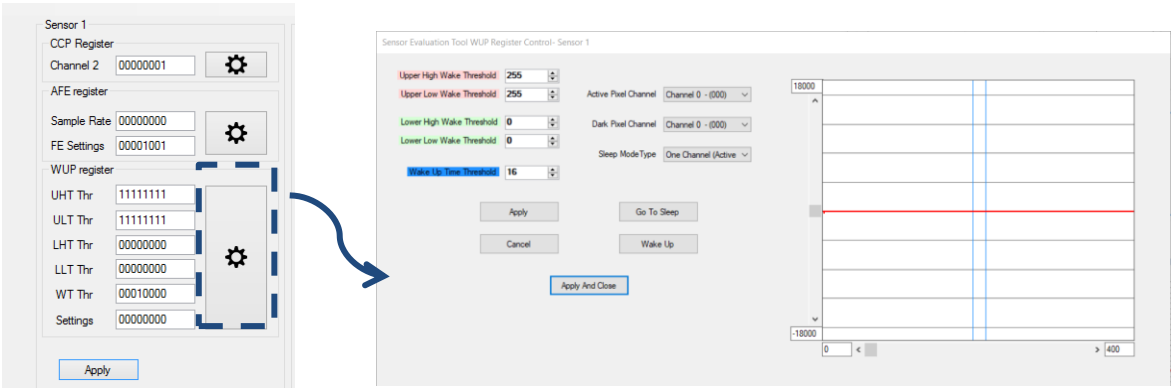

Figure 10 – WUP Cog Single-Pixel Sensor View Sensor 1

3.2 Saturation

Sometimes when the device is first started it will saturate for a period of time before it settles. This can take up to 10 seconds to stop. Typical saturation events are shown in the figure below. If the sensors are uncovered, and the gain and transconductance setting are set to maximum, signal saturation due to air flow is likely.

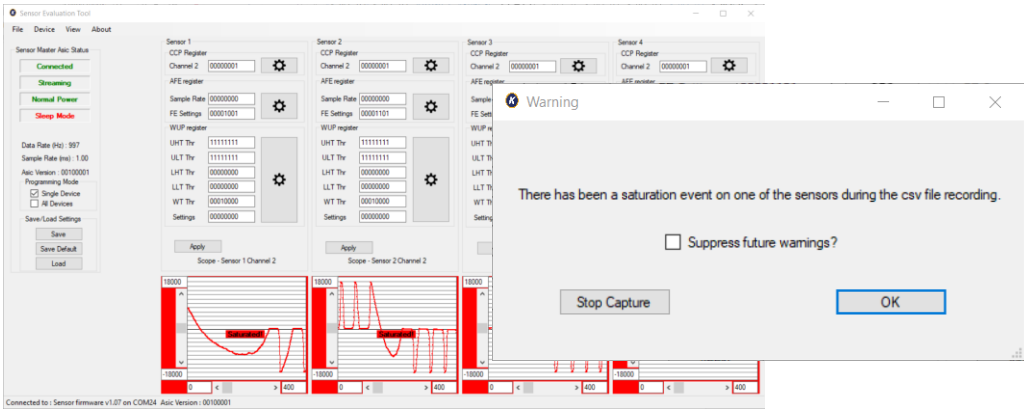

Figure 11 – Changing CCP Registers Directly – Saturation and Warning Message for CSV Capture

If saturation occurs during a csv file writing operation (see Section 6), a warning dialog is displayed. Click on the **Stop Capture** button to cancel the recording of data. The dialog also offers the option to suppress the saturation warning message in future.

When a saturation event occurs, “Saturation Occurred”, is added to the file name and the saturated values are changed to 65535 in the appropriate data column. This ensures that the event is easy to identify when viewing files. It also allows any analysis to be easily accomplished without having to do any pre-processing of the data.

3.3 Multiple Sensor Single-Pixel Views

The Sensor Evaluation Tool detects sensors when the device is connected to the PC and adjusts the display accordingly.[5]

Figure 12 – 1 (Top), 2 (Middle) and 3 (Bottom) Sensor Single-Pixel Views

[5] Sensors must be connected in numerical order. For example, if you want to use two sensors ensure they are placed in positions 1 and 2.

3.4 Programming Modes

By default, **Single Device** programming mode is selected. In this mode the settings for all sensors can be set independently. To apply the same register settings on all the devices select the **All Devices** check box. In this mode, if the settings for any of the sensors are changed then the setting for all other sensors are also changed.

For example, clicking **Apply** for Sensor 2, after making changes to Sensor 2, will apply the changes to all the sensors. Clicking **Apply** for any of the other sensors will update all the sensors to the settings of that sensor, not the changed settings of Sensor 2.

This does not apply to the master/slave bit, as only one sensor can be the master. Single device mode must be used to change the master to a different device.

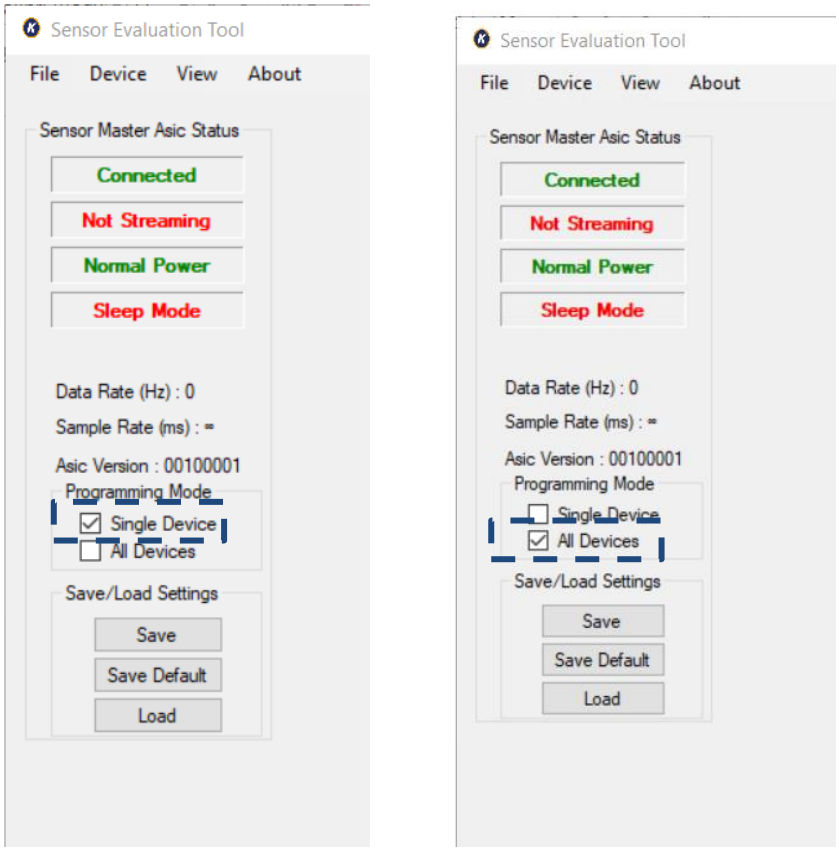

Figure 13 – Single Devices and All Devices Programming Modes

If one of the configuration cogs is clicked while **All Devices** mode is active, **Single Device** programming mode is set automatically. Apply changes to the configuration form (see Section 3.1) as required. To apply these changes to all sensors, select **All Devices** and then click the **Apply** button for the sensor.

3.5 Saving and Loading Settings

Click on the **Save** button to save the current settings for all sensors. To restore settings saved previously, click on the **Load** button, and then browse to the required file.

4 SINGLE 2X2 PIXEL VIEW

When the software starts, it displays a set of registers for each connected device (up to four). With a 2x2 array sensor (a single device incorporating 4 pixels) connected, the Sensor Evaluation Tool initially displays only one set of registers.

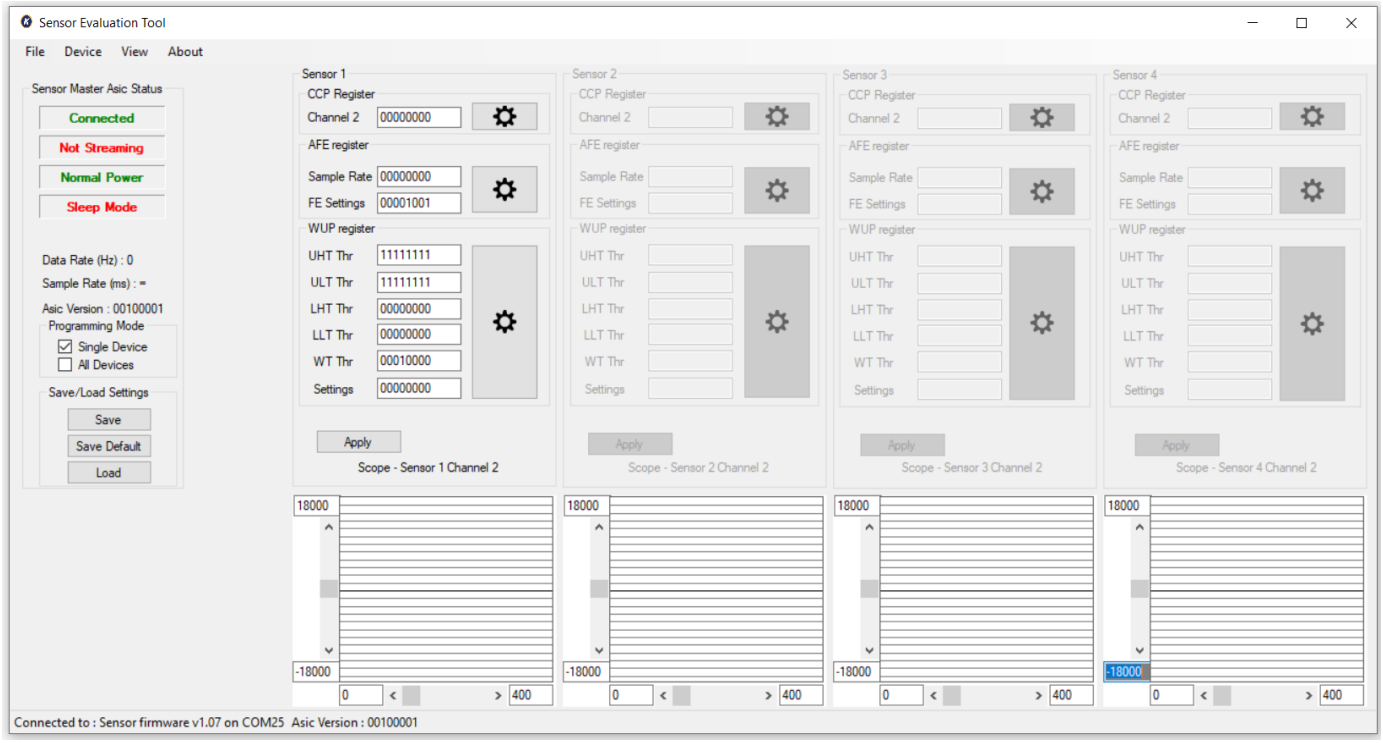

Figure 14 – Sensor Evaluation Tool with 2x2 Sensor Array Connected

To display registers for each channel in the array, select **Single 2x2 Array Sensor View** from the **View** menu.

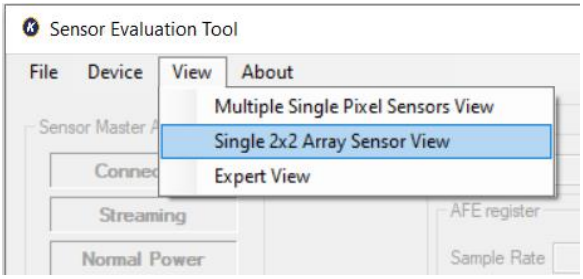

Figure 15 – Selecting Single 2x2 Array Sensor View

In **Single 2x2 Array Sensor View**, the text above each scope states which channel is being displayed. In **Multiple Single-Pixel Sensors View**, the pixel is always attached to Channel 2.

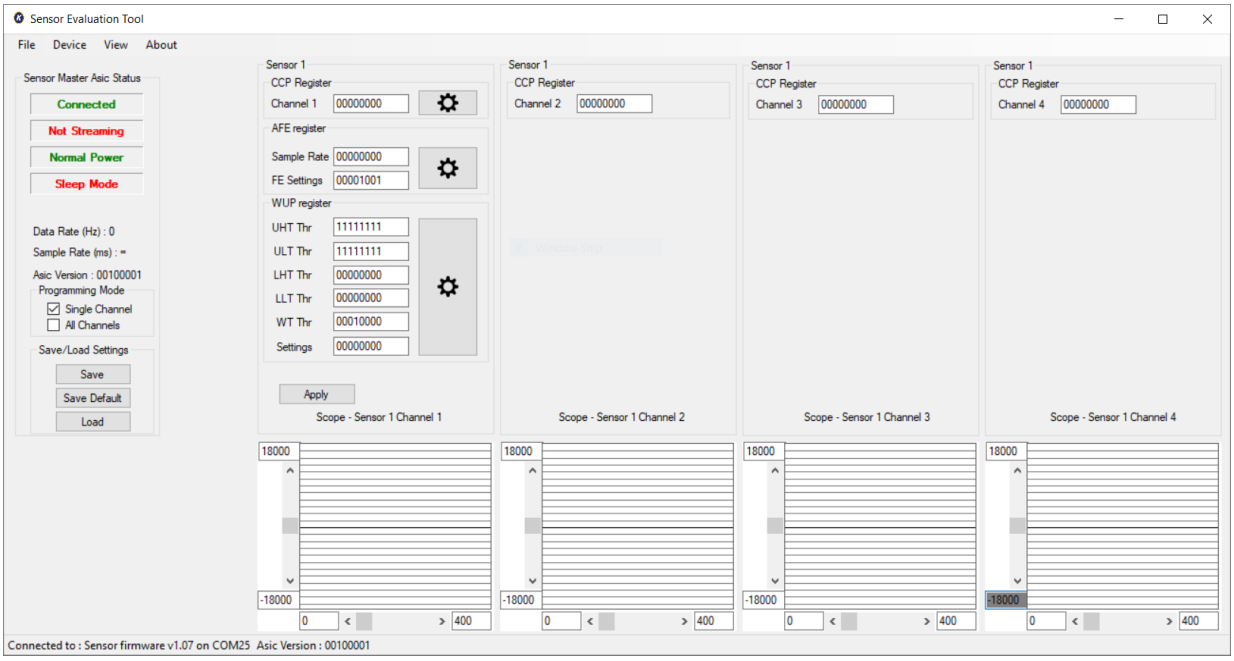

Figure 16 – Single 2x2 Array Sensor View in Single Channel Programming Mode

In this view, the available programming modes are **Single Channel** or **All Channels**. With **All Channels** selected, the register boxes for channels 2, 3 and 4 are greyed and disabled with the settings from Channel 1 applying to all channels. Click on the **Apply** button to confirm any changes to the register settings.

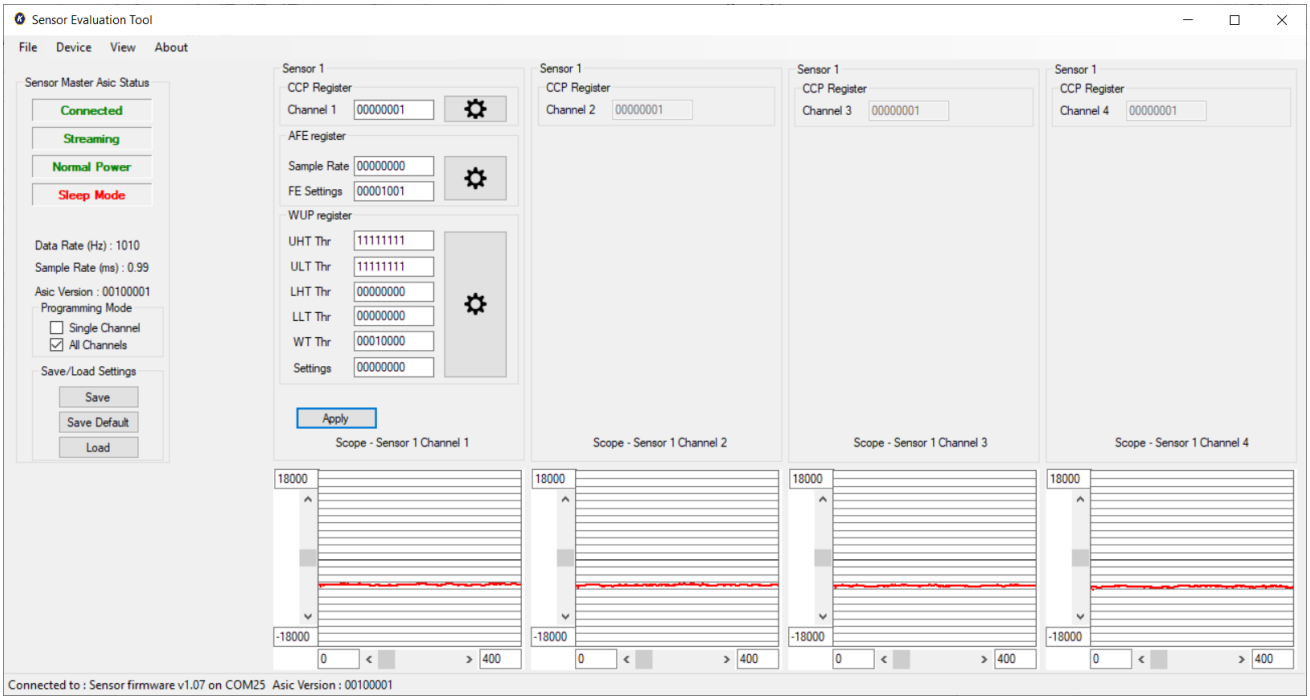

Figure 17 – Single 2x2 Sensor View - All Channels Programming Mode

4.1 Register Control Settings

Click on the cog adjacent to the CCP Register settings to display the **Register Control** dialog box. If **All Channels** mode was enabled, **Single Channel** programming mode is disabled, and the registers can now be programmed independently. In Single Channel programming mode, only Channel 2 settings are displayed, and these apply to all four sensors.

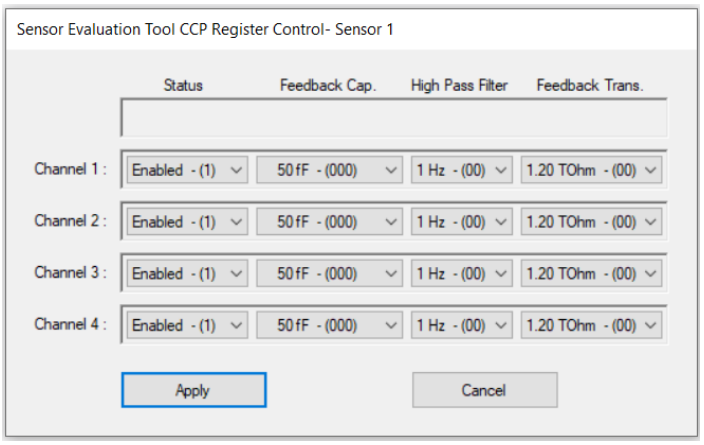

Figure 18 – Single 2x2 Sensor View - CCP Register Control Dialog Box

5 EXPERT VIEW

For a more detailed view of the sensor and additional options select **Expert View** from the **View** menu.

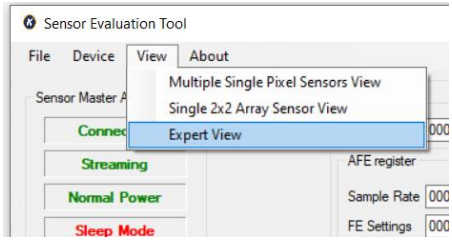

Figure 19 – Opening Expert View

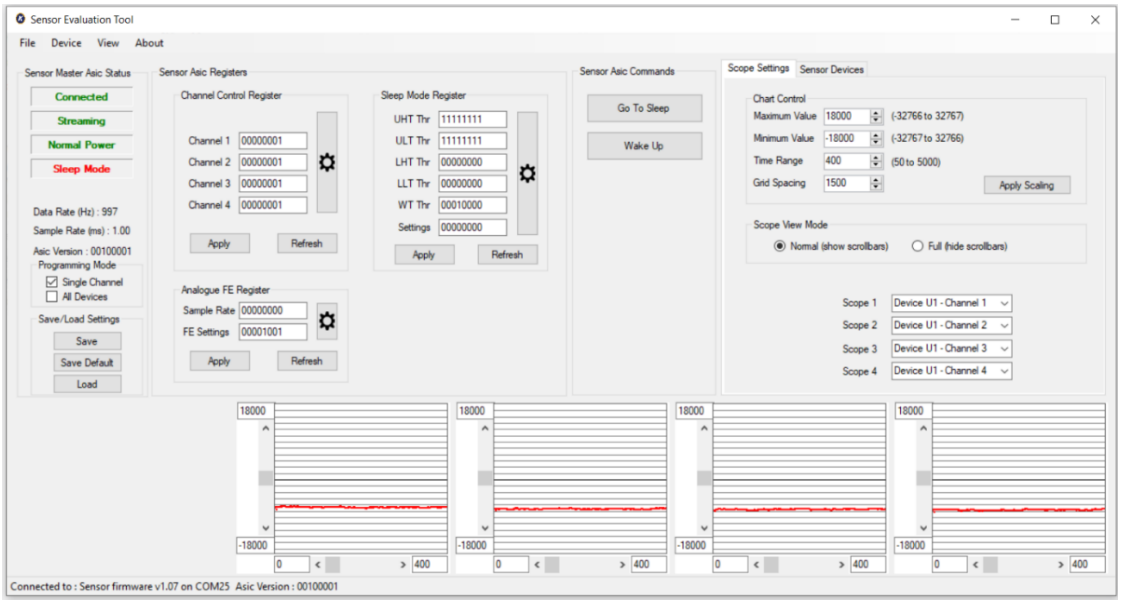

Figure 20 – Expert View

Use Expert View to put the device into Sleep Mode, edit the scopes and assign device channels to them, and to control an emitter, if one is connected. The emitter controls are always displayed even if no emitter board is connected (there is no feedback from the board for the software to ascertain if a connection is present).

There are two tabs: **Scope Settings** and **Sensor Devices**.

5.1 Sleep Mode

Use the Sensor Evaluation Tool to put a device into Sleep Mode. However, the software does not allow the device to be subsequently forced to wake up. It is therefore important that the Sleep Mode WUP registers are manually set to values that allow a wake up condition to be met before the device is put into Sleep Mode. Please refer to the *SMD Sensor Reference Manual* for details.

To put a device into Sleep Mode, click on the **Go To Sleep** button.

5.2 Wake Up Settings

For valid wake up settings, the UHT and ULT cannot be set to the same value, the LHT and LLT cannot be set to the same value, the thresholds cannot be set to the maximum and minimum values. The WUT threshold must be set to at least the minimum number of samples.

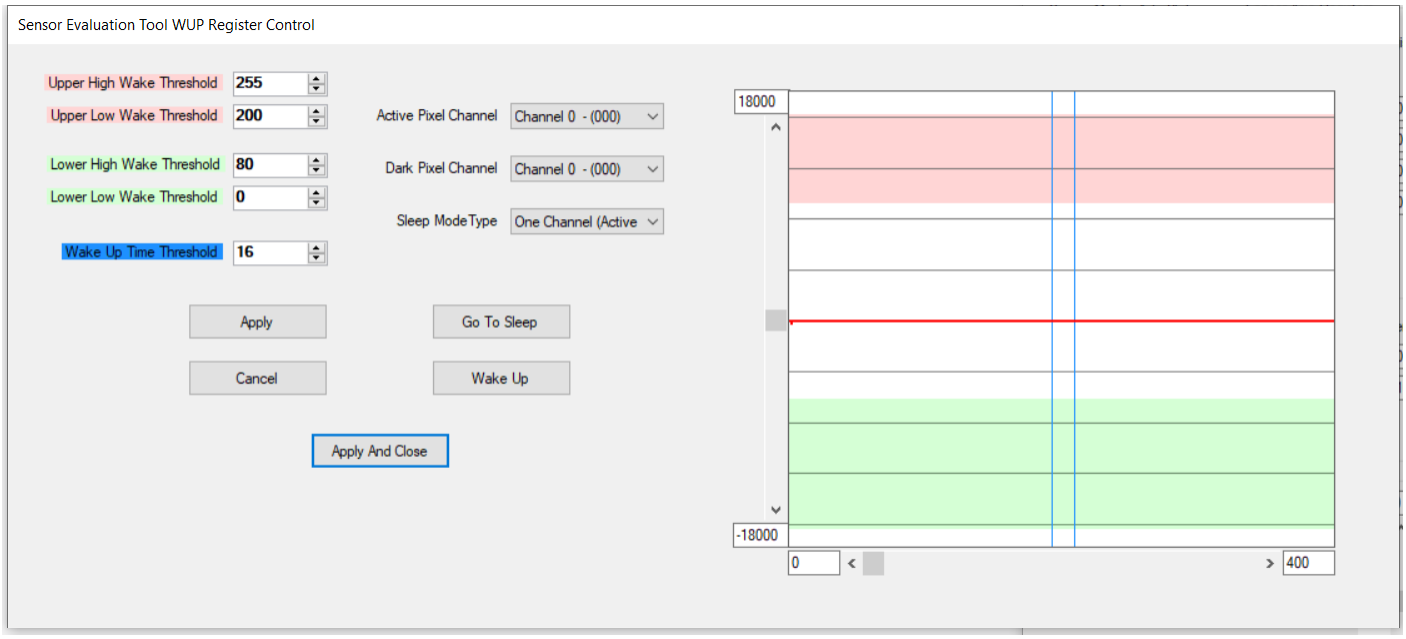

Figure 21 – Valid LHT, LLT, UHT and ULT Settings

If these conditions are not met, the following warning message is displayed.

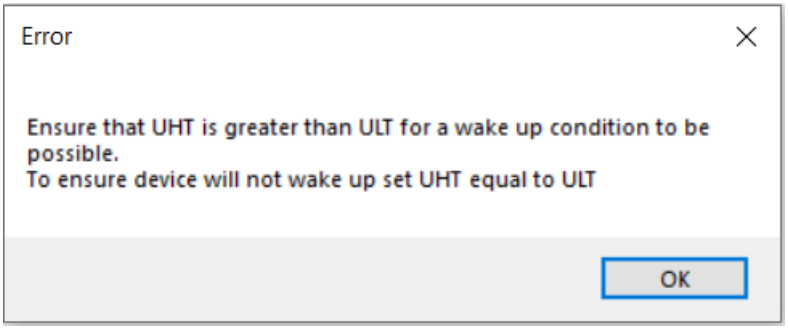

Figure 22 – Wake Up Settings Warning Message

5.3 Scope Settings

Use the **Chart Control** settings to configure the X and Y scales and grid spacing on the four scopes. Select the channels to be displayed by the four scopes using the **Scope 1**, **Scope 2**, **Scope 3** and **Scope 4** dropdown boxes.

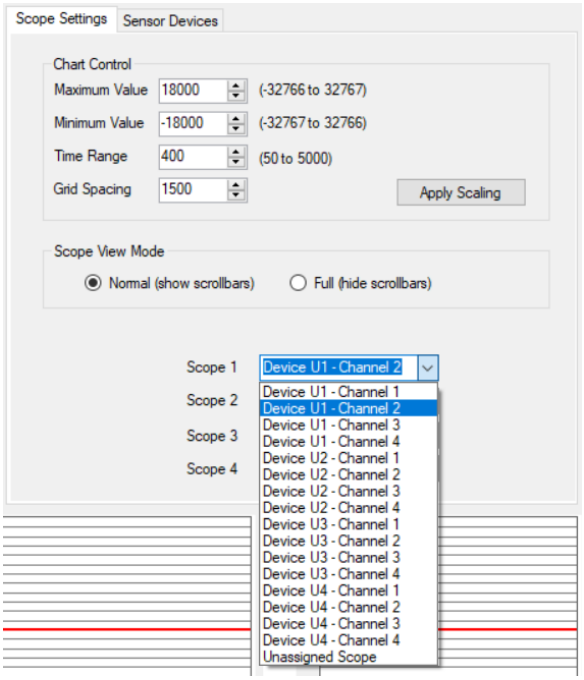

Figure 23 – Scope Settings Showing the Dropdown Device List for Scope 1

5.4 Sensor Devices

This tab shows the **Emitter Control** settings. The graphic on the right hand side shows which of the devices is currently active and editable on the tab. The active registers are shown in green. Click on another device (for example, U4) to update the tab with that device's register settings.

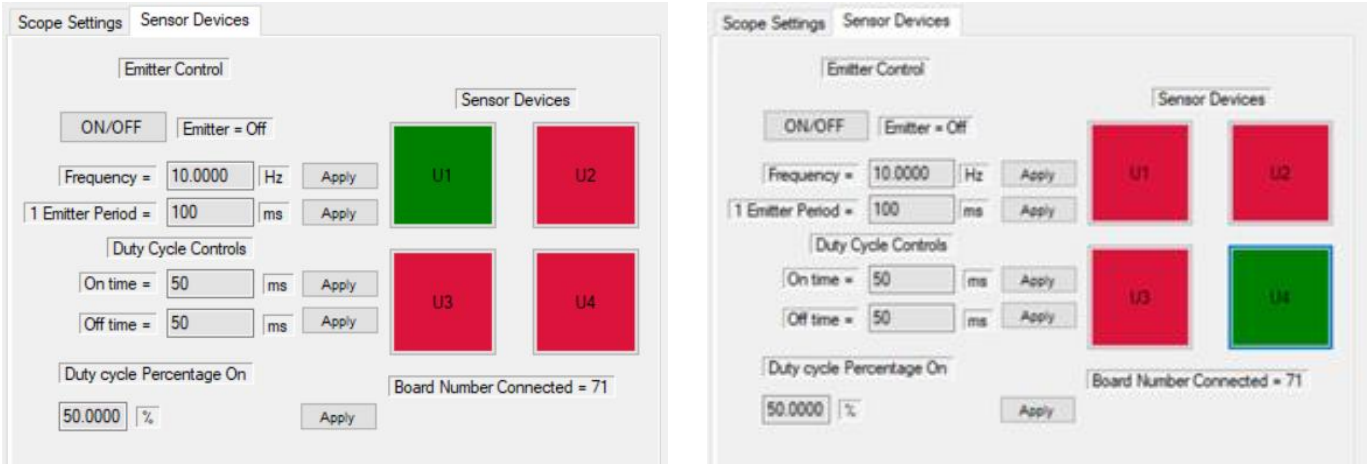

Figure 24 – Sensor Devices Tab in Single Device Programming Mode with U1 (Left) and U4 (Right) Settings Selected

By selecting the **All Devices** programming mode, all the sensor graphics are coloured green and the text boxes display the last individually selected device.

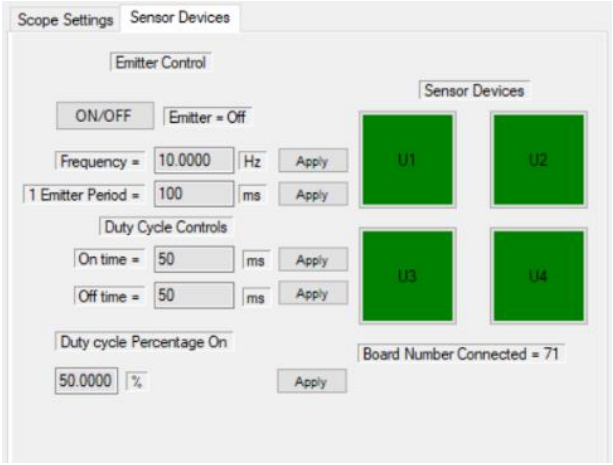

Figure 25 - Sensor Devices Tab - All Devices Programming Mode

5.5 Register Control in Expert View

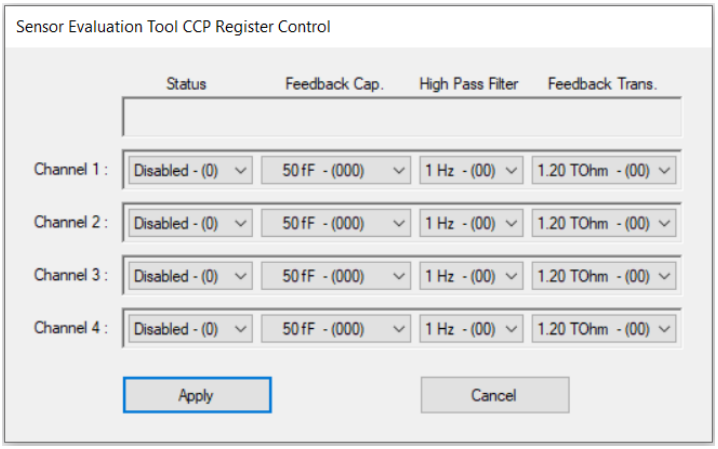

Figure 26 – CCP Register - Detailed View

In Expert View, the **Register Control** dialog boxes (displayed by clicking on the cog buttons) display descriptions of the registers in the same way with the exception of the CCP Register. This is because the single-pixel sensor view is designed for sensors with a single-pixel. Therefore most of the CCP registers are not required. However, in Expert View no assumption is made about pixel numbers and the additional registers are displayed.

6 SAVING DATA TO CSV FILE

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

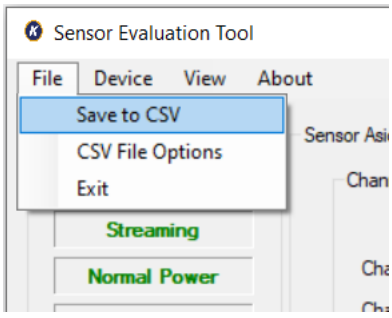

Figure 27 – Save to CSV

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

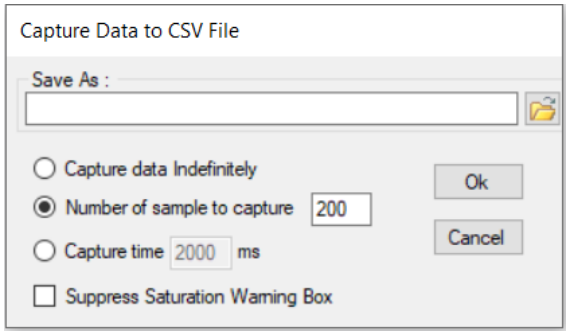

Figure 28 – Save to CSV Clicked

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 “KEMET” folder if it exists or “My Documents” if it does not. The “KEMET” 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 until **Stop CSV Capture** is selected from the **File** menu.
- **Number of sample to capture**: Save a specific number of samples according to the sampling rate set in **CSV File Options**.
- **Capture time ms**: Record data for a set time interval (in milliseconds).

6.1 Data Sampling Rates

1. Choose **CSV File Options** from the **File** menu to set the timing interval for data sampling.

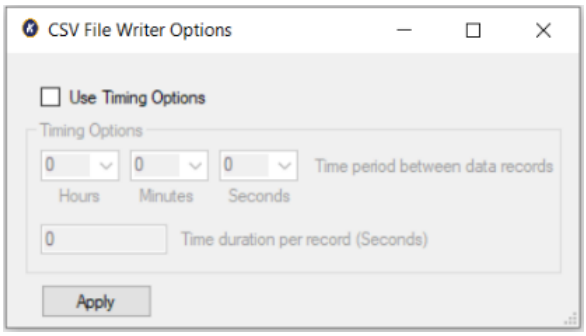

Figure 29 – CSV Options Clicked

2. Select the **Use Timing Options** checkbox.

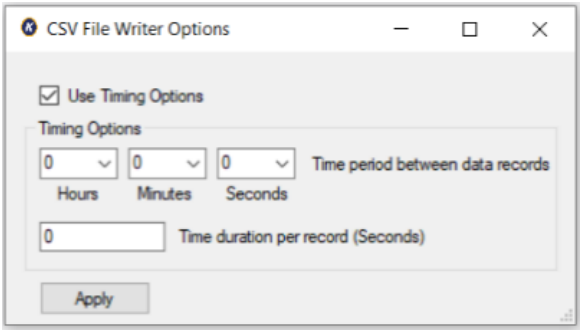

Figure 30 – Enabling CSV Options

3. Input values for:

- **Time period between data records**: the delay between consecutive data samples
- **Time duration per record (Seconds)**: the time of each record.[6]

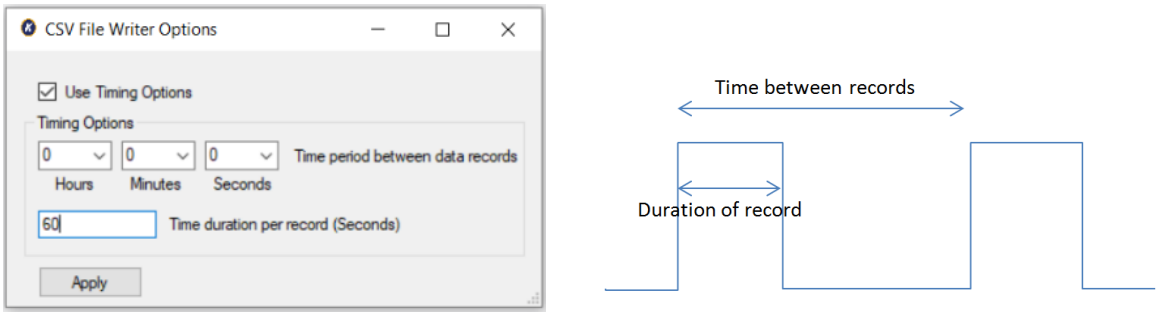

Figure 31 – Applying Data Sampling Times

4. Click on the **Apply** button.

Invalid timing options result in a warning message being displayed. If this occurs, correct the settings, and reapply.

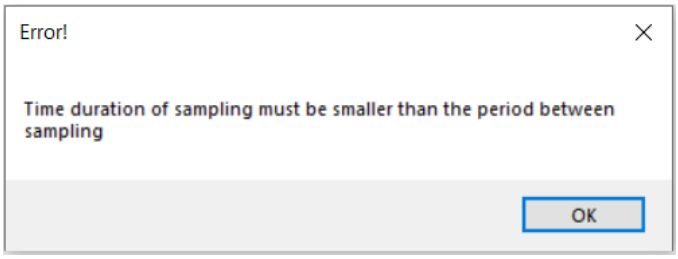

Figure 32 – CSV Options Error Message

7 SAVING AND LOADING CONFIGURATION FILES

There are two options for saving the current settings in configuration files:

- **Save**: Create and save the configuration in a text file in any location ("Documents\KEMET" if unspecified).
- **Save Default**: As above, but also create or overwrite the default configuration file applied whenever the software initially connects to a device. This file has the name "default.txt" and is located in the "Documents\KEMET\Sensor Evaluation Tool" folder.

7.1 Saving Settings

To save the current set of register settings for future use:

[6] The duration of each record cannot be greater than or equal to the delay between consecutive records.

1. Click on the **Save** button.

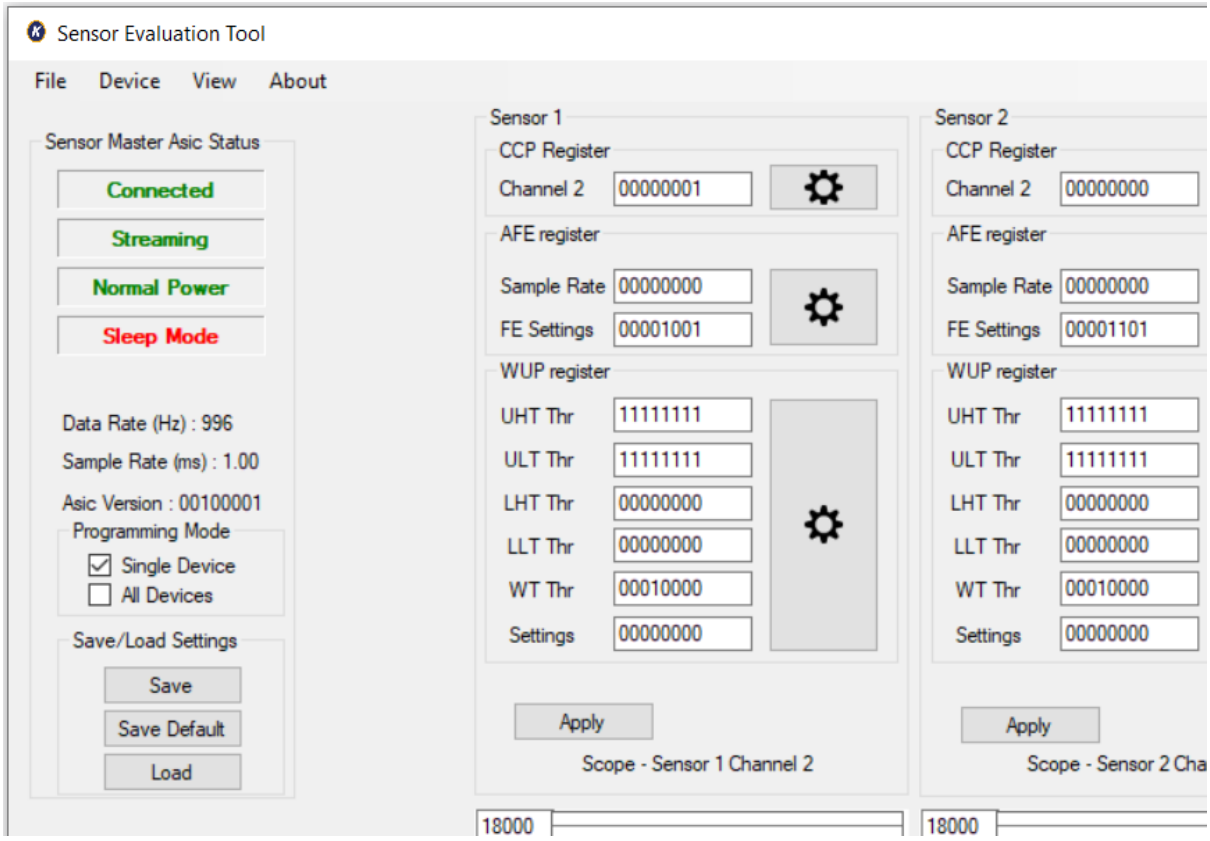

Figure 33 – Save and Load Buttons

2. A Save As dialog box is displayed. By default, files are saved in a folder called “KEMET” in the “Documents” folder.

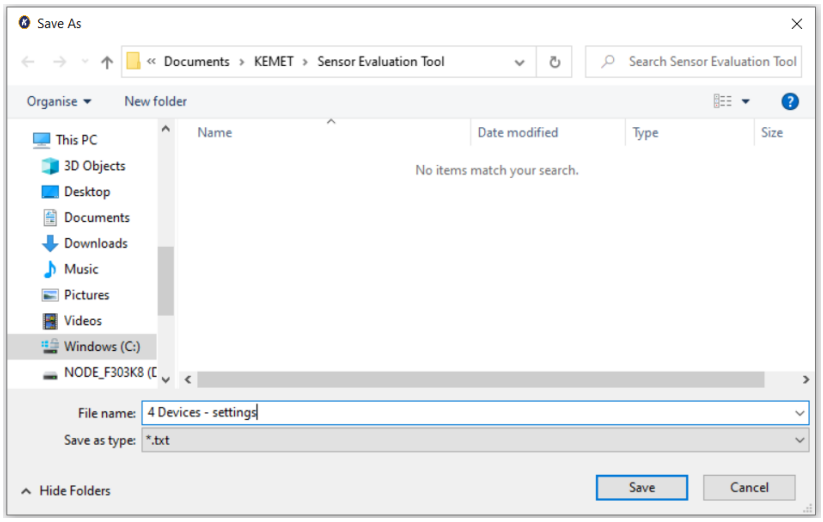

Figure 34 – Saving Settings - Doc Title

3. Enter a suitable file name for the settings. The settings file is saved as a text file (.txt extension).
4. Click on the **Save** button.

7.2 Saving the Default Configuration

Click on the **Save Default** button to update the default configuration used by the software. You are given the option to save the configuration under another filename as described in the previous section. When confirmed, a second version of the configuration is saved as “default.txt’ in the “Documents\KEMET\Sensor Evaluation Tool” folder. If the file already exists, it is overwritten. The default configuration file is applied to a device whenever the software first connects to it.

7.3 Loading Settings

To apply a previously saved set of registry settings:

1. Click on the **Load** button
2. An Open dialog box is displayed.

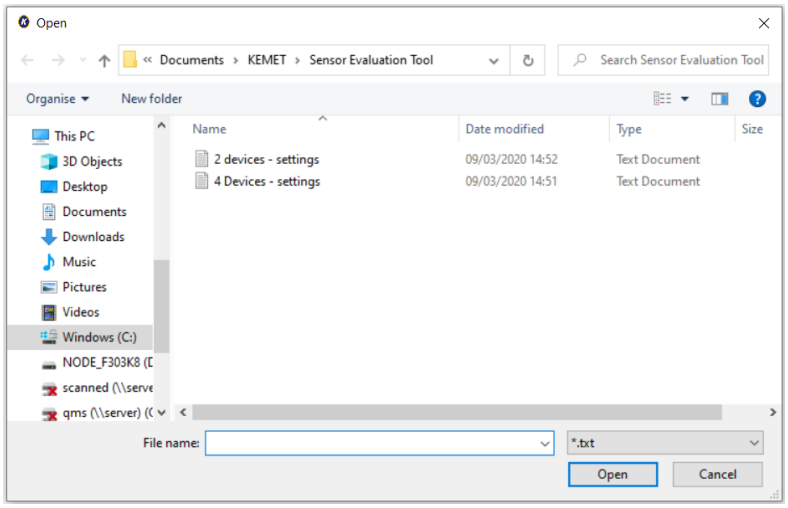

Figure 35 – Load Settings - Select File

3. Select the required settings file.
4. Click on the **Open** button. The register settings are applied to the currently active device(s).[7]

8 ABOUT

Click on **About** in the menu bar to display file and version information about the Sensor Evaluation Tool software.

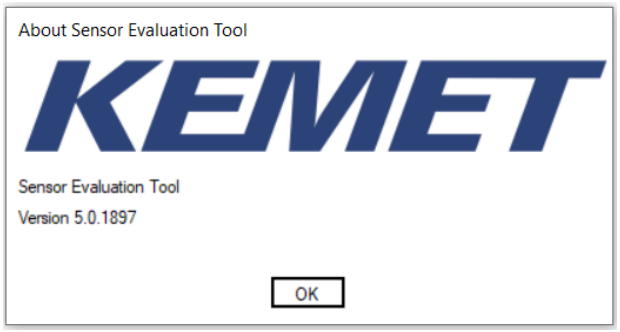

Figure 36 – About Box

[7] Configuration files are specific for the number of devices used: for example, a configuration file for 2 sensors will not work for 1, 3 or 4 sensors.

9 LIST OF ABBREVIATIONS

AFE	Analog Front End
CCP	Channel Control Packet
CSV	Comma Separated Values
HPF	High Pass Filter
LHT	Lower High Threshold
LLT	Lower Low Threshold
LPF	Low Pass Filter
WT	Wake-Up Time Threshold
WUP	Wake-Up Packet
UHT	Upper High Threshold
ULT	Upper Low Threshold