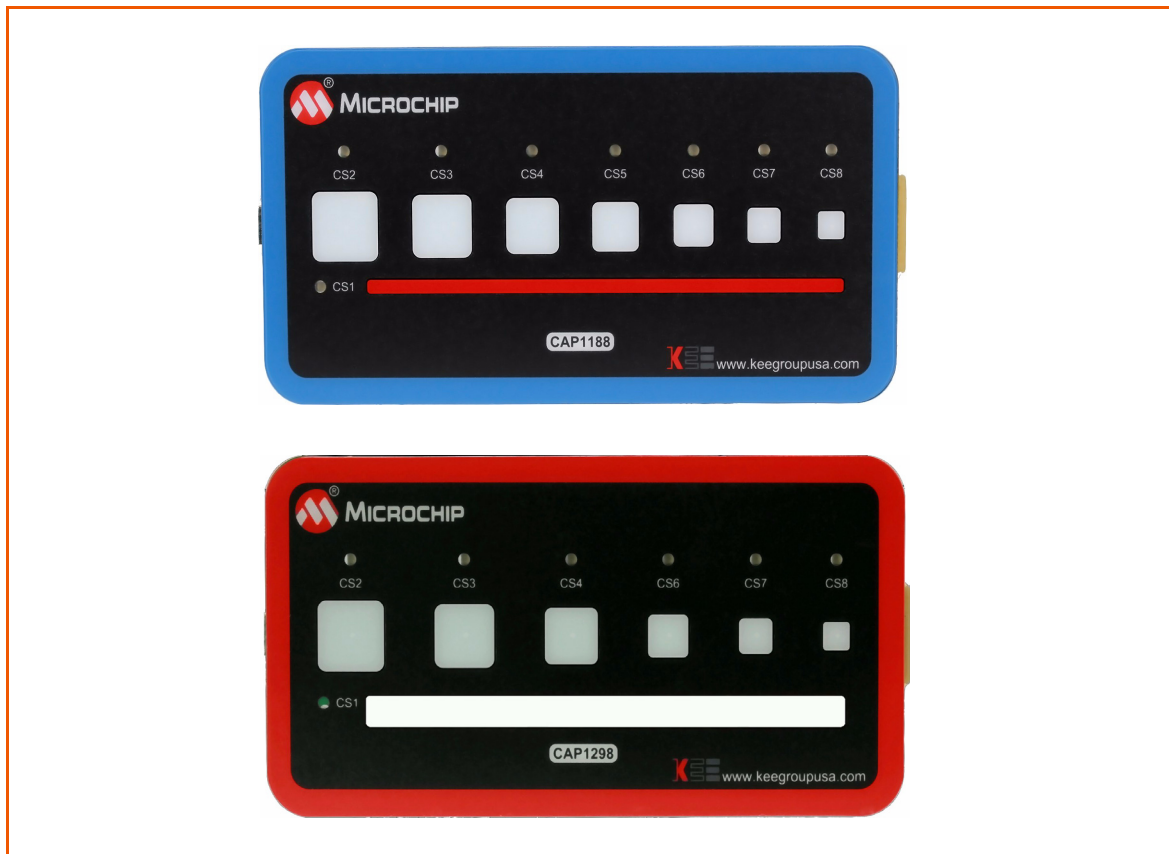# CAP1xxx Evaluation Board User's Guide

1 Overview

This document provides a description of the software and hardware used to demonstrate the features of the Microchip CAP1xxx Family of RightTouch™ multiple-channel capacitive touch controllers and LED drivers. Two evaluation boards are covered in this User's Manual. The CAP1188 evaluation board contains the largest, full-featured version of the CAP11xx family. The other devices in this family are the CAP1166, CAP1128, CAP1126, CAP1133, and CAP1106. Likewise, the CAP1298 evaluation board contains the largest, full-featured version of the CAP12xx family. The other devices in this family are the CAP1296, CAP1293, CAP1208, CAP1206, and CAP1203.

1.1   References

Readers should be familiar with or have access to the datasheet for the device and the schematic for the evaluation board.

- The datasheet is included with the CD provided with the evaluation board, and can also be downloaded from the Microchip website at http://www.microchip.com/mtouch.

- The schematic is included with the CD provided with the evaluation board.

1.2   The RightTouch Evaluation System

The evaluation system has three major parts, as shown in Figure 1.1:

- Customer-provided Windows PC

- CAP1xxx graphical user interface (GUI) software (based on National Instruments™ LabVIEW™ software)

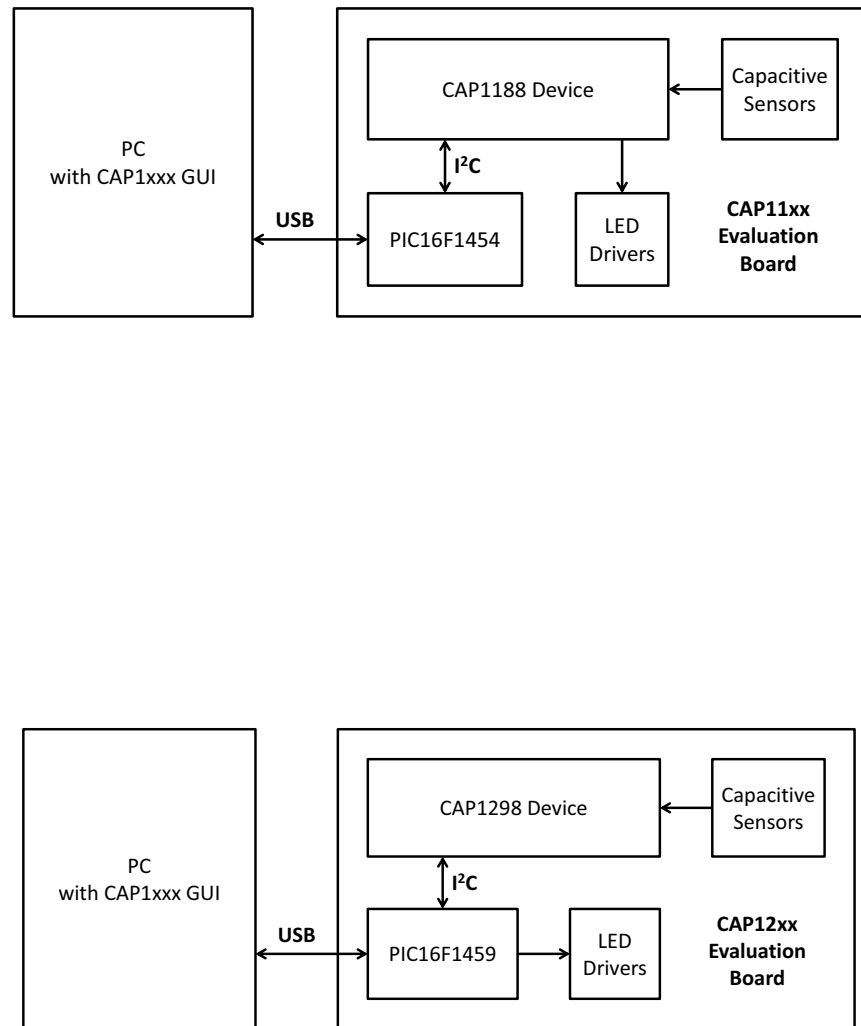- CAP1xxx Evaluation Board - either the CAP1188 or CAP1298 versions (see Figure 1.2)

Figure 1.1 CAP1xxx Evaluation System

Figure 1.2 CAP1xxx Evaluation Board Top View

1.2.1   Capacitive Sensing Device on the Evaluation Board

The CAP1188 device was chosen for the evaluation board because it has the most sensors and LEDs in the CAP11xx family.

Note: The CAP1114 and CAP1214 devices, each with 14 sensors and 11 LED drivers, contain additional features such as slider support which will be highlighted in their own evaluation board.

The CAP1298 device was chosen for the evaluation board because it is the superset device in the family, meaning it has the most sensors and features in the CAP12xx family including the signal guard.

The CAP1188, CAP1166, CAP1128, CAP1126, CAP1133, and CAP1106 are similar, with the exception of the number of capacitive sensor inputs and LED drivers, as shown in Table 1.1.

Table 1.1 CAP11xx Device Differentiation

DEVICE	NUMBER OF LED DRIVERS	NUMBER OF CAPACITIVE SENSOR INPUTS
CAP1133	3	3
CAP1106	0	6
CAP1126	2	6
CAP1166	6	6
CAP1128	2	8
CAP1188	8	8

The CAP1298, CAP1296, CAP1293, CAP1208, CAP1206, and CAP1203 part of the same family and so have a very similar feature set, with the major exception being of the number of capacitive sensor inputs and the guard output, as shown in Table 1.2.

Table 1.2 CAP12xx Family Device Differentiation

DEVICE	NUMBER OF CAPACITIVE SENSORS	GUARD
CAP1203	3	No
CAP1293	3	Yes
CAP1206	6	No
CAP1296	6	Yes
CAP1208	8	No
CAP1298	8	Yes

1.2.2   Major Components on the Evaluation Board

Figure 1.3 shows the component side of the CAP1188 evaluation board and highlights some of the important components.
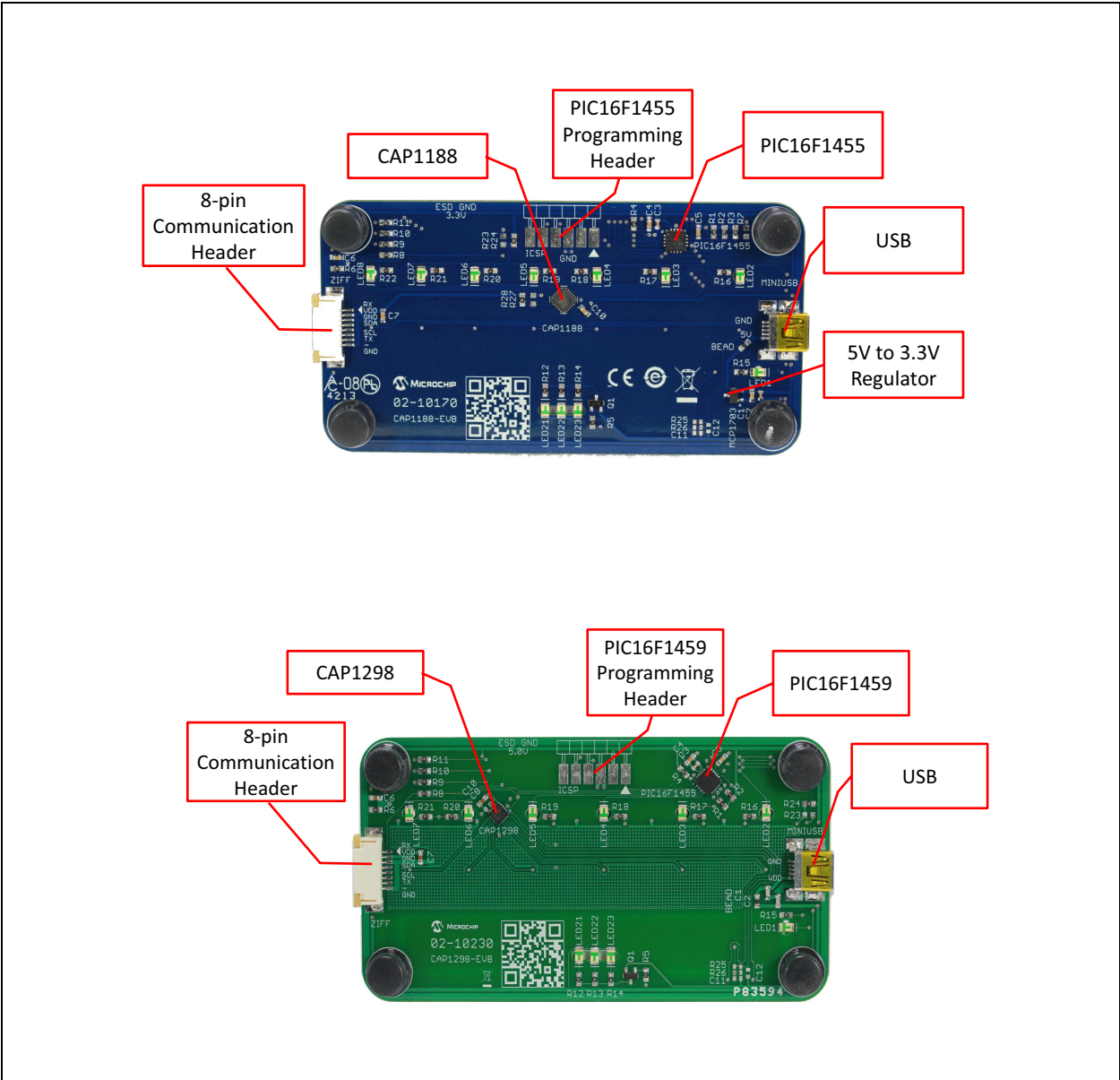
Figure 1.3 Evaluation Board Component Side View

2 Software and Hardware Installation

To begin using the CAP1xxx evaluation board, you only need to supply power by plugging in the USB connector. However, in order to further evaluate the features of the CAP device, the CAP1xxx GUI must be installed on a Windows-based computer with a USB port.

2.1 GUI Software Installation

Begin by inserting the CD provided with the evaluation board into the computer. Run the Setup.exe program located in the root directory of the CD. This steps through the CAP1xxx GUI installation, which takes less than a minute. Figure 2.1 shows the initial installation screen, which displays briefly as the setup program loads.
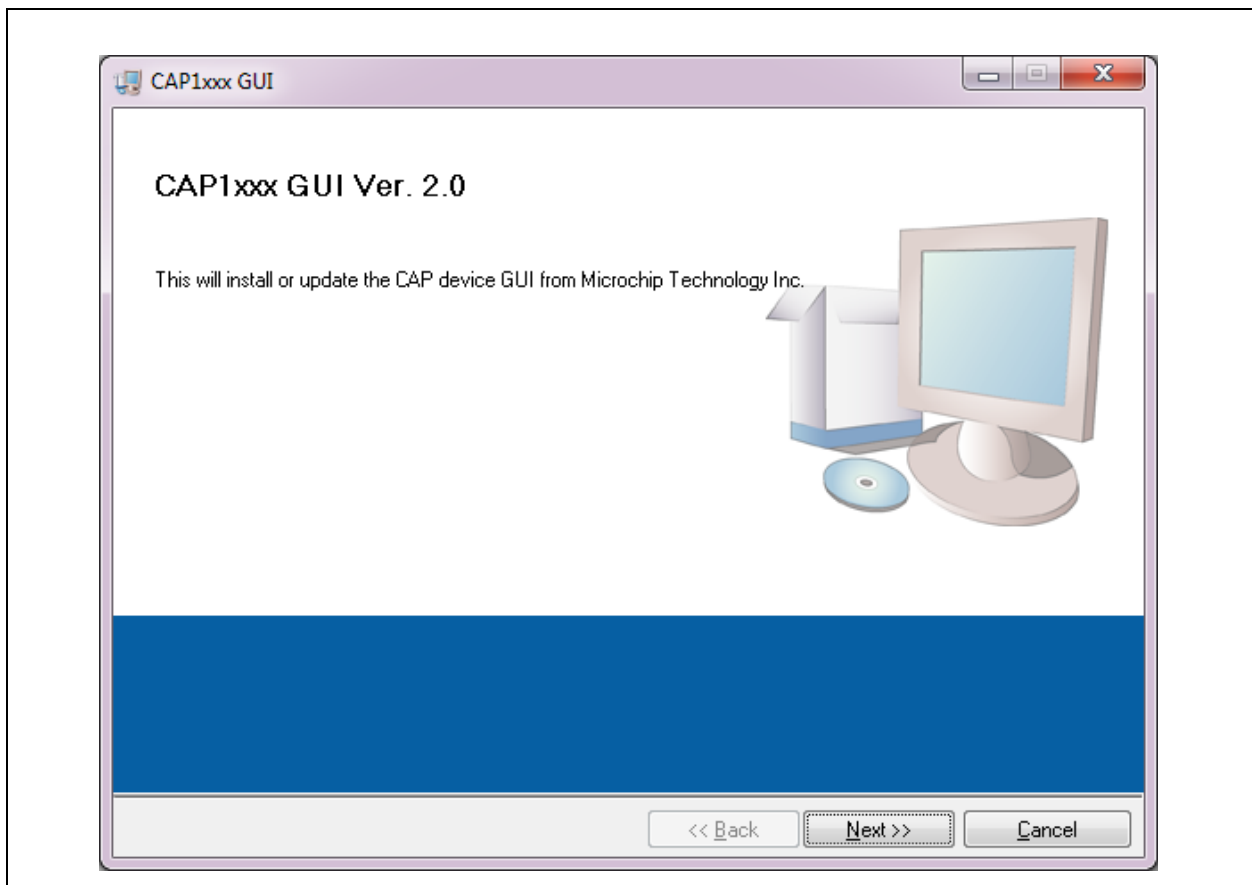

Figure 2.1 Software Installation Step 1

Click Next in the Destination Directory window, shown in Figure 2.2. For proper operation, the files must be installed in the default locations. The default location for the software files is C:\Program Files\Microchip\Microchip CAP1xxx GUI and for the LabVIEW™ software is C:\Program Files\National Instruments.
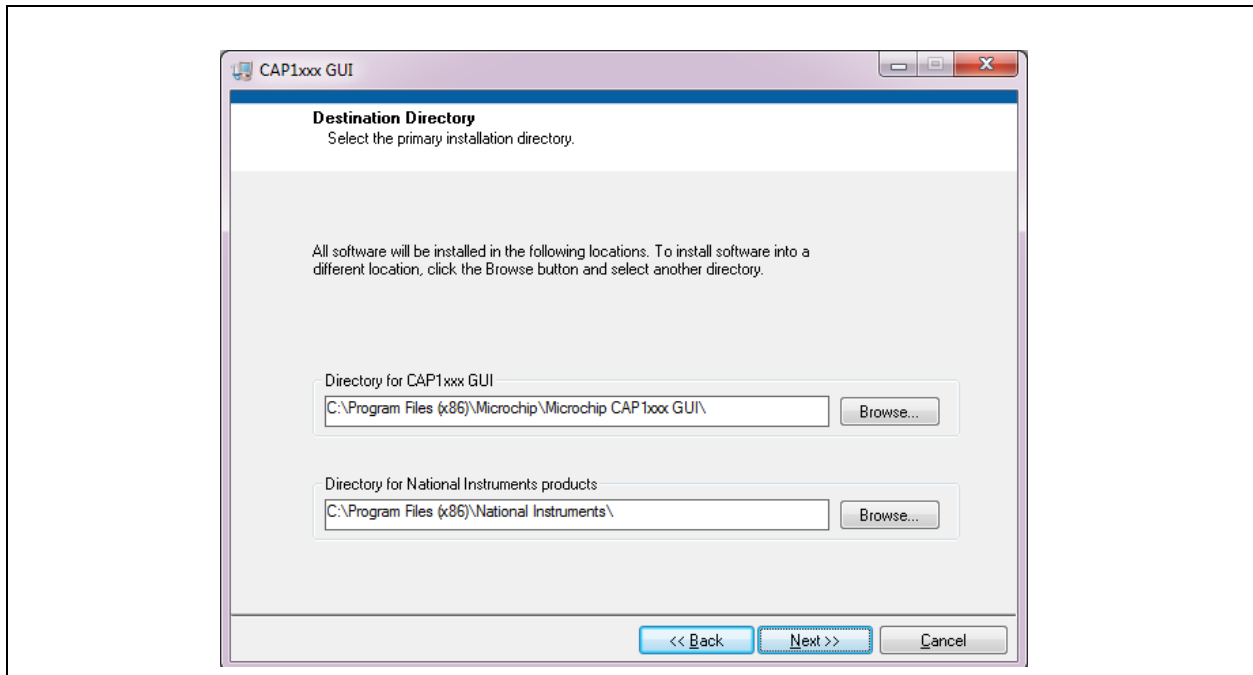

Figure 2.2 Software Installation Step 2

In order to use the LabVIEW™ software, the license agreement must be accepted (see Figure 2.3).
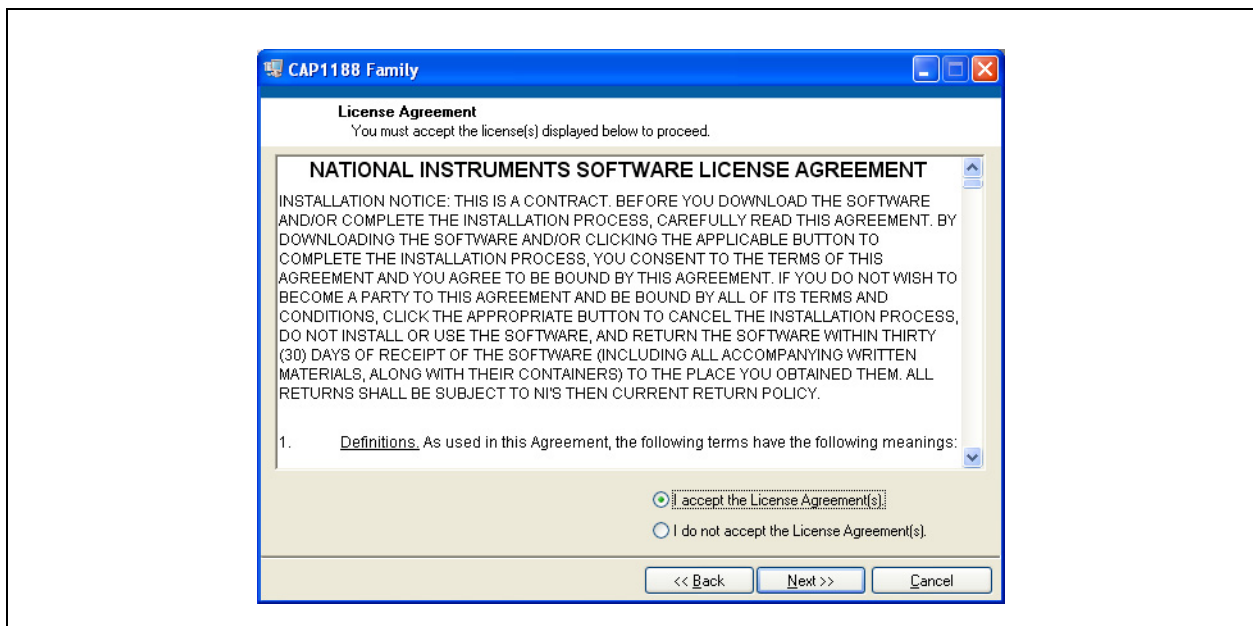

Figure 2.3 Software Installation Step 3

Follow the on-screen instructions to complete the installation. During installation, shortcuts will be created on the Windows Start Menu and on the desktop. When installation is complete, the program will automatically run and begin looking for the PIC16F145x USB to I2C bridge. (see Figure 2.4).
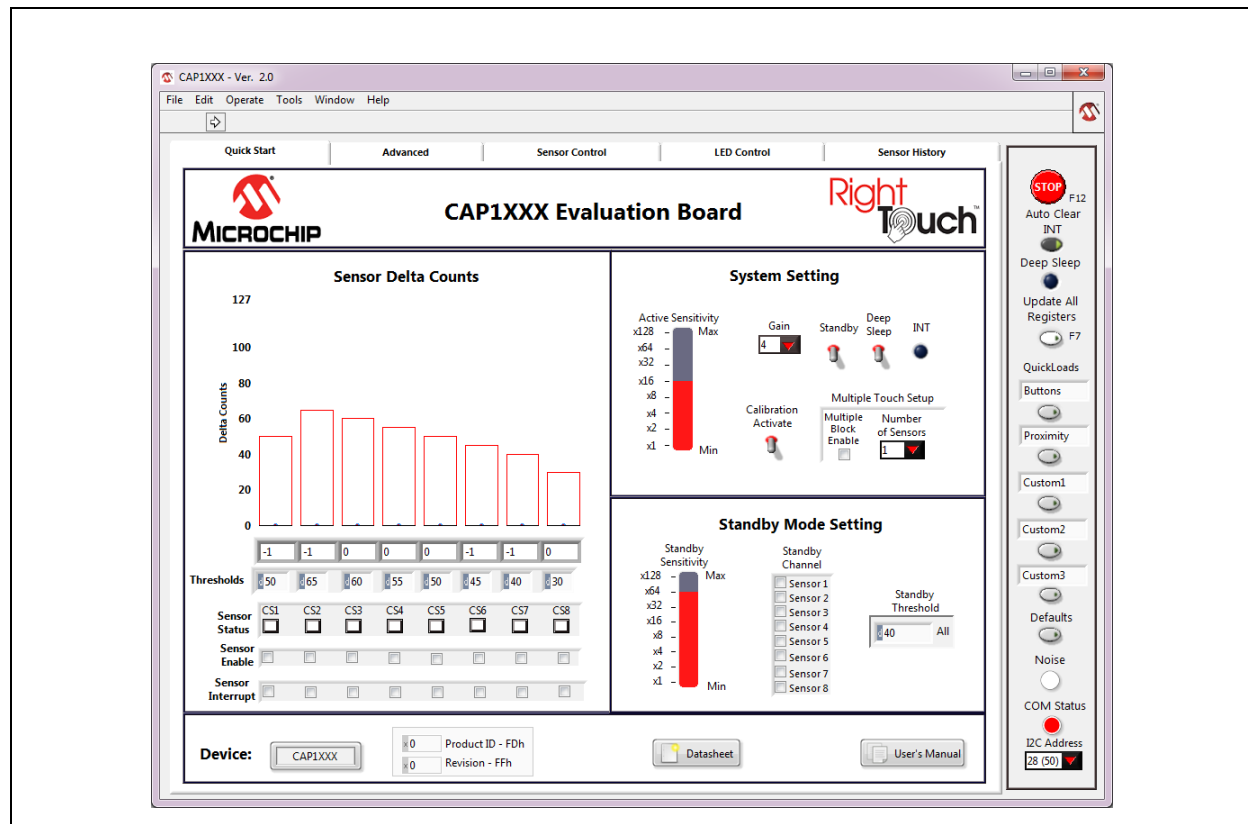

Figure 2.4 RightTouch Evaluation Software Start-up Screen

2.2   USB Bridge Installation

To complete the installation, connect the USB mini connector to the EVB and the standard USB connector to any available USB port on the PC. If the USB Bridge driver has not previously been installed on the selected USB port, the "Find New Hardware" wizard will pop up on the PC's screen. Follow the on-screen instructions to complete the installation process. See Figure 2.5 through Figure 2.8 for a step by step view of the installation.

Once installation of the USB Bridge is complete, the GUI software will begin communications with the device on the EVB.
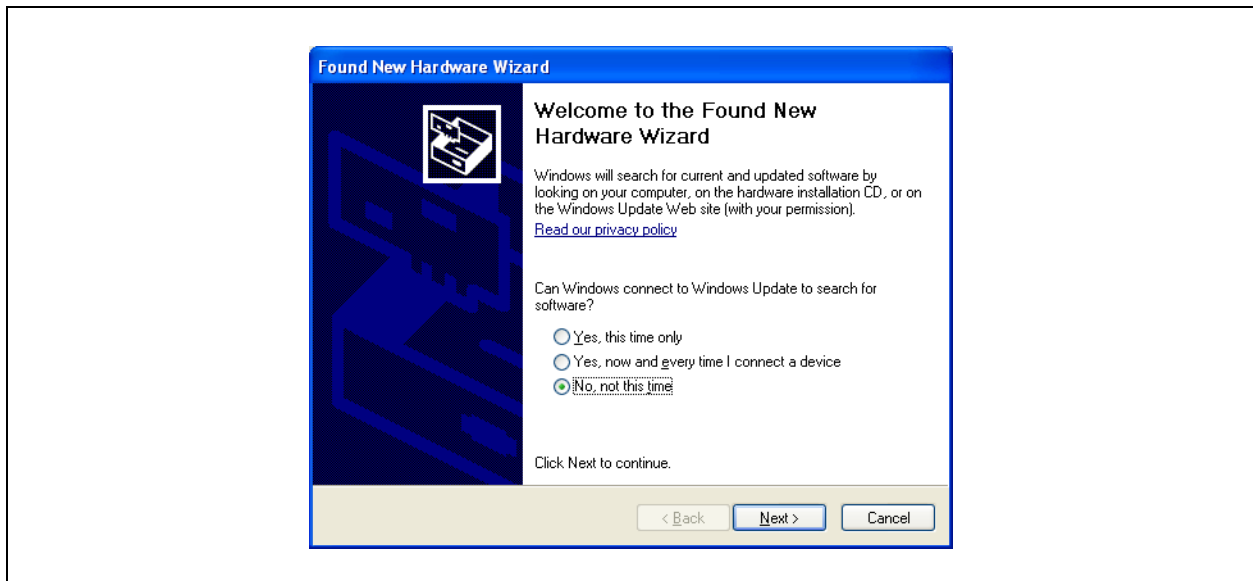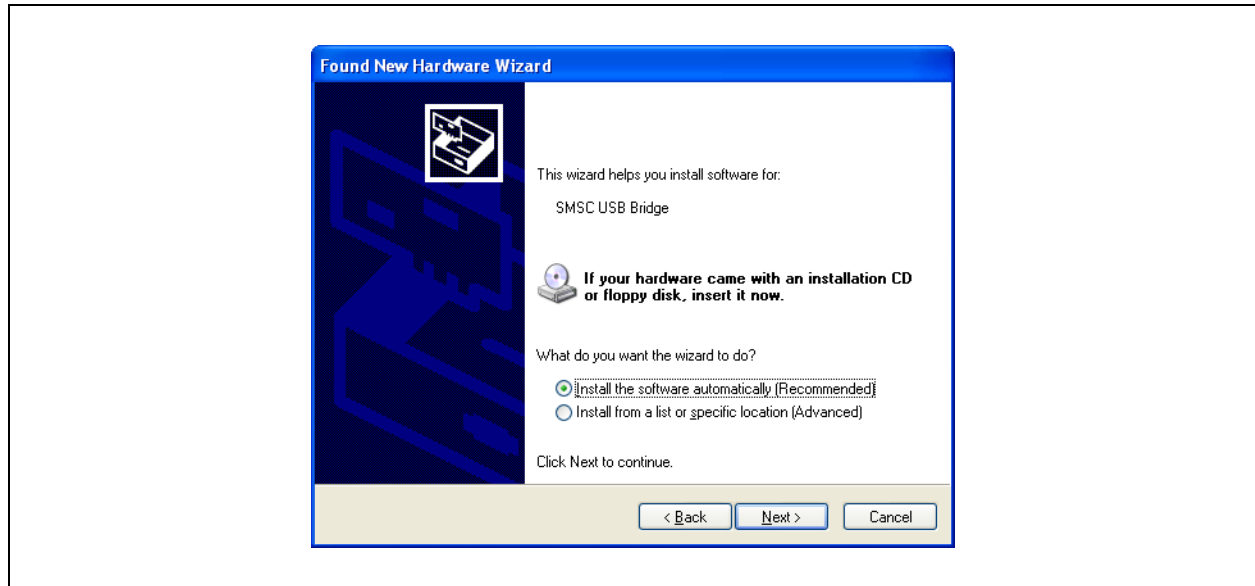

Figure 2.5 USB Bridge Driver Installation Step 1
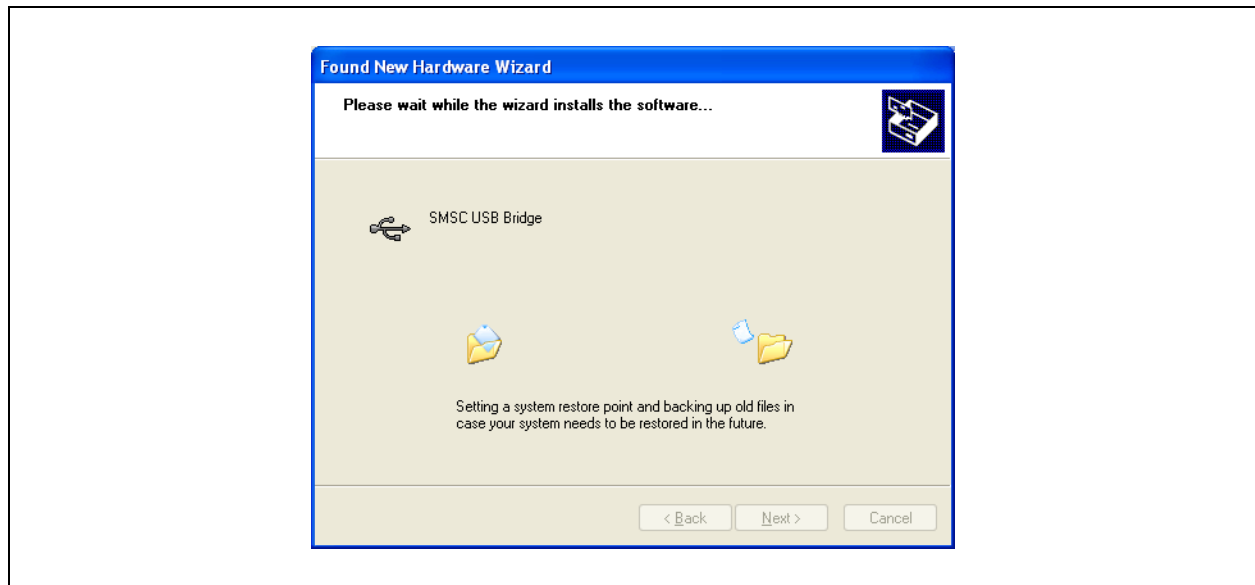
Figure 2.6 USB Bridge Driver Installation Step 2

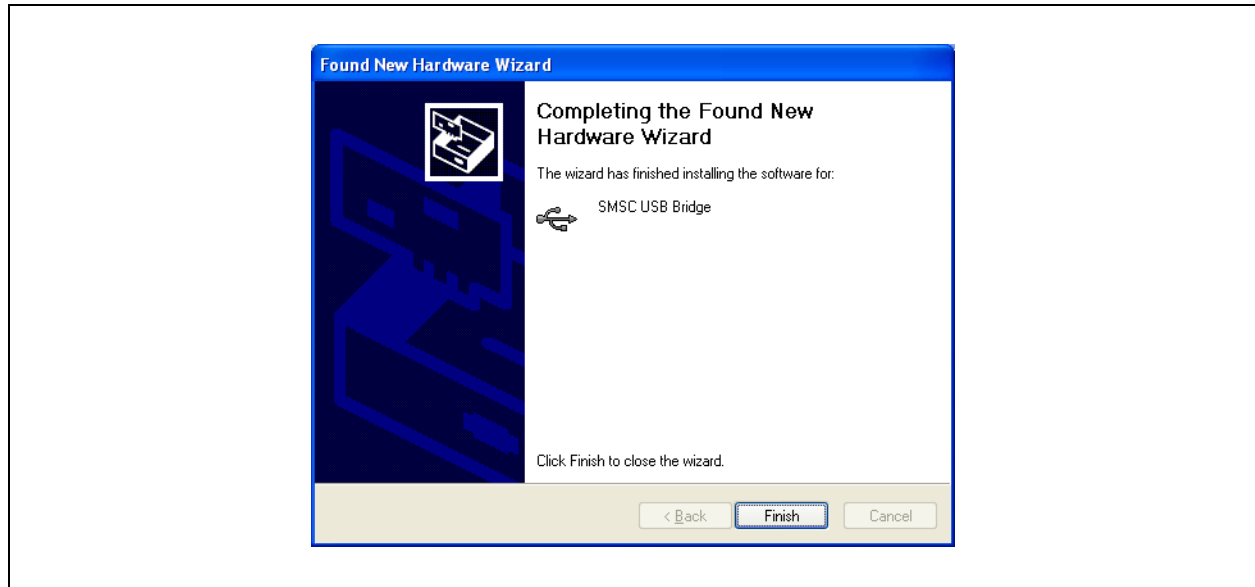**Figure 2.7 USB Bridge Driver Installation Step 3**

Figure 2.8 USB Bridge Driver Installation Step 4

3 Quick Start Window

The Quick Start Window provides the same information as the Advanced Window, but reduces the number of options for a more manageable initial user experience. For more information on what options are provided on the Quick Start Window and how to use them, refer to the CAP1xxx Quick Start Guide provided with the CAP1xxx CD.

4 Advanced Tab

4.1   Default Conditions

Communications begin as soon as the CAP1xxx GUI software detects the presence of the CAP1xxx evaluation board. The GUI then reconfigures the CAP1xxx evaluation board with predetermined values specific to the evaluation board's hardware. Figure 4.1 shows the default GUI for the CAP1188 evaluation board.
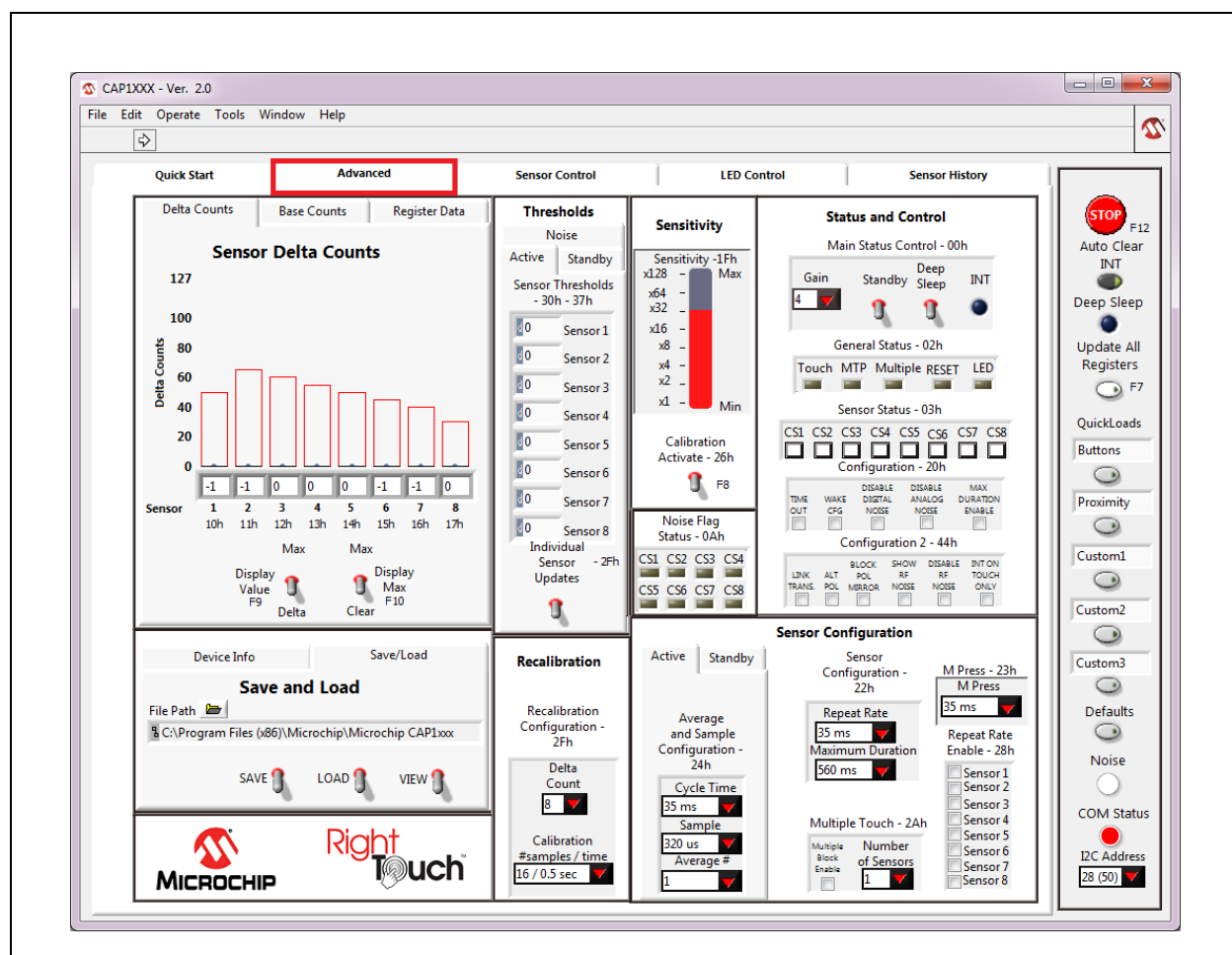

Figure 4.1 Default State of RightTouch GUI with the CAP1188 Evaluation Board

4.2 Tips for Using the RightTouch Evaluation System

- For many items on the GUI control panels, the register address is listed after the control name.

- After communications are established between the GUI and the evaluation board, the GUI will reconfigure the device. Users can save setting configurations to user-named files which can be reloaded at any time for quick re-configuration (see Section 4.4, "Save/Load Tab").

- QuickLoad options are provided on the right to quickly change the evaluation board's behavior between 'Buttons', 'Proximity', and 'Metal over Capacitive'.

4.2.1 Numbering Systems Views

Some control panels allow values to be displayed using different numbering systems: Decimal, Hex, Octal, Binary or SI Notation.

To view a value using a different numbering system, click the indicator to the left of the value in the cell, shown circled in Figure 4.2.

Figure 4.2 Numbering System Indicators

4.2.2 Keyboard Shortcuts

Some GUI controls have keyboard shortcuts, as shown in Table 4.1.

Table 4.1 CAP1188 Family EVB GUI Keyboard Shortcuts

GUI CONTROL	SHORTCUT	CONTROL DESCRIPTION
Run	CTRL + R	Section 4.5.1, "Stop and Run Buttons"
Load Buttons file	F1	Section 4.5.5, "QuickLoad Buttons"
Load Proximity file	F2	Section 4.5.5, "QuickLoad Buttons"
Load MOC file	F3	Section 4.5.5, "QuickLoad Buttons"
Load Custom1 file	F4	Section 4.5.5, "QuickLoad Buttons"
Load Custom2 file	F5	Section 4.5.5, "QuickLoad Buttons"
Load Defaults	F6	Section 4.5.6, "Defaults Button"
Update All Registers	F7	Section 4.5.4, "Update All Registers"
Calibration Activate All	F8	Section 4.9, "Sensitivity Control Panel"
Stop	F12	Section 4.5.1, "Stop and Run Buttons"

4.3 Device Information and Datasheet Link

In addition to the device name lighting up on the evaluation board and displaying in the software title bar, the Device Information Control Panel also shows the device that has been populated on the

evaluation board. Figure 4.3 shows the Device Information Control Panel for the CAP1188 evaluation board.. This control panel also shows the values from reading the Product ID Register (FDh) and Revision Register (FFh) on the device.
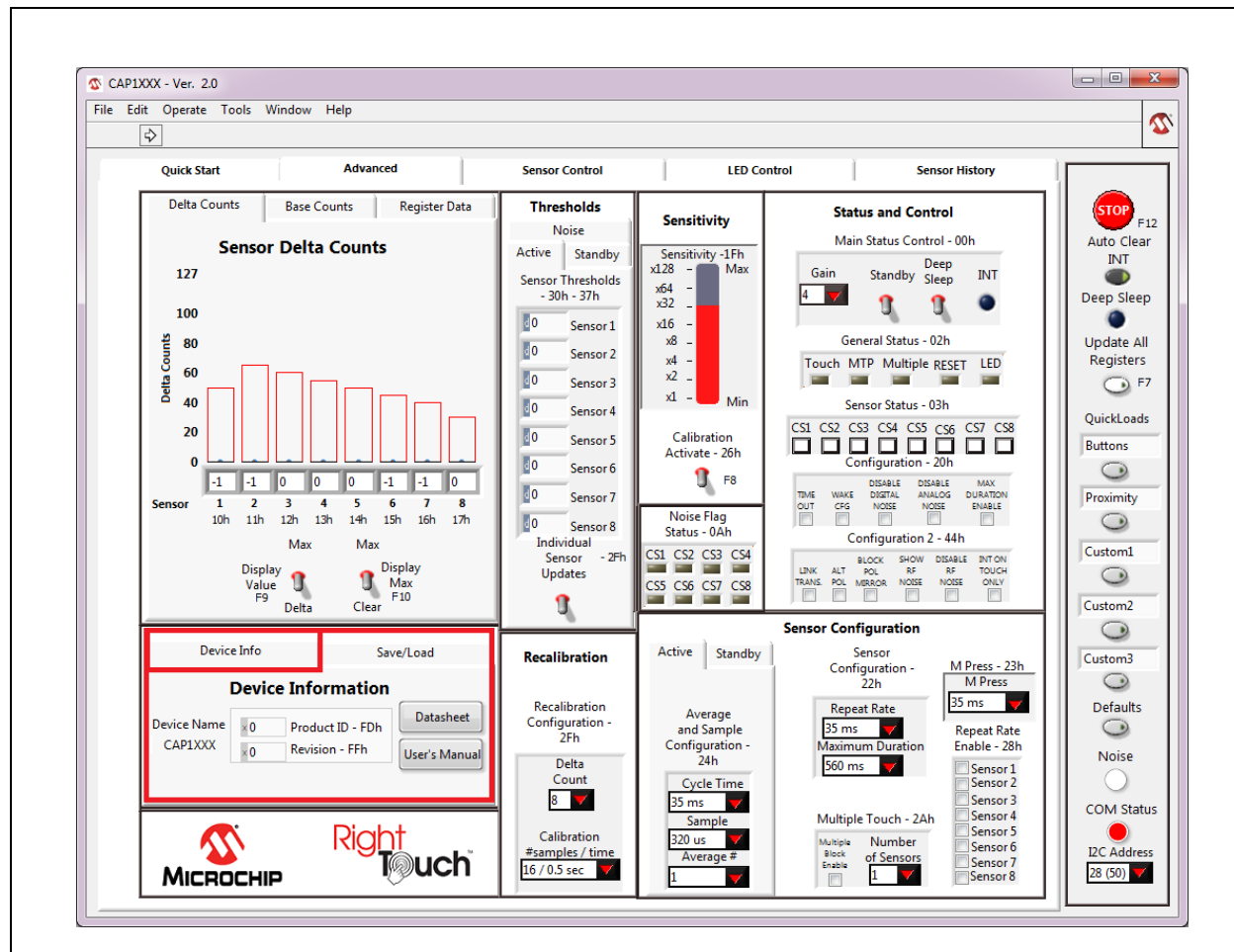

Figure 4.3 Device Information Control Panel

Clicking the Datasheet button opens a browser window that will display a PDF file of the datasheet of the connected device.

4.4   Save/Load Tab

The Save/Load tab, located in the lower left corner of the Advanced Tab and shown in Figure 4.4, allows the user to save all the settings that have been configured for the device to allow quick re-configuration at any time.
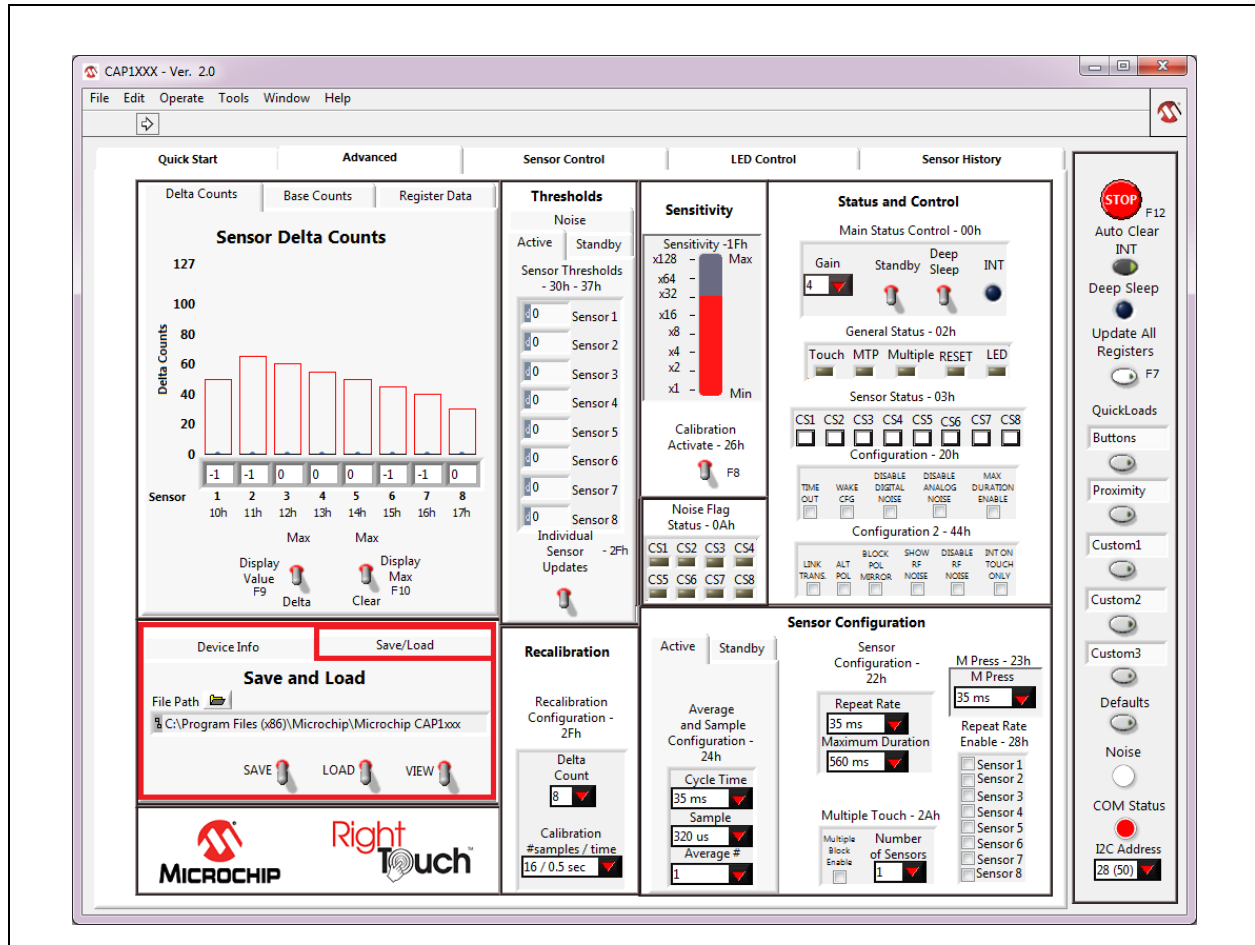
Figure 4.4 Save/Load Tab

To save device configuration settings:

- Using the GUI, configure the CAP1xxx as desired.

- Select the Save/Load tab.

- Type in a path, or click the folder icon to browse to your desired save location.

- Click the 'SAVE' switch to store the configuration.

Notes:

1. The file should be named with the extension '.txt' or similar plain-text file format. The data is saved in two columns separated by tabs. The first column is the register's address, and the second column is the register's value.

2. If a file with the same name already exists, the file will be overwritten and old data will be lost.

3. When a file is loaded, the Auto Clear INT button is disabled. Click it to re-enable auto-clearing of interrupts (see Section 4.5.2, "Auto Clear INT").

Once a file is saved, it can be recalled at any time by selecting the file in the data path window and clicking the "LOAD" switch. The file can also be linked to a QuickLoad button (see Section 4.5.5, "QuickLoad Buttons").

The evaluation board GUI comes with several sample configuration files which vary the settings for different functions.

4.5   Communications Status and Control Panel

Along the right side of the GUI is the control panel shown in Figure 4.5. This is the Communications Status and Control Panel, which controls and displays the status of the communications between the GUI software and the evaluation board and includes buttons for loading configurations. This control panel is always displayed.
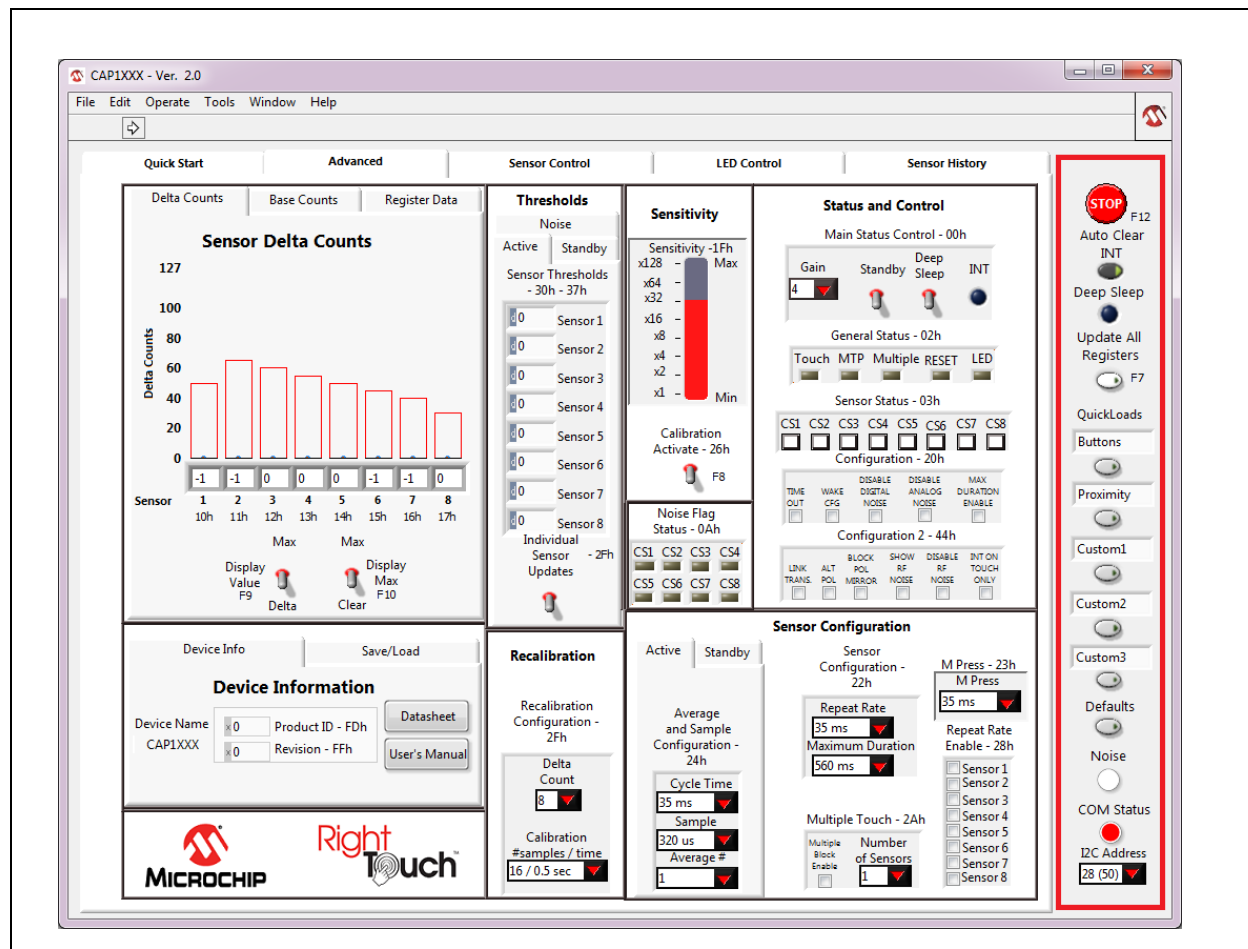

Figure 4.5 Communications Status and Control Panel

4.5.1 Stop and Run Buttons

The STOP button, on the Panel shown in Figure 4.5, halts GUI software communication with the evaluation board. When this button is clicked, the Run button, which has an arrow on it, displays below the menu bar, as shown in Figure 4.6.
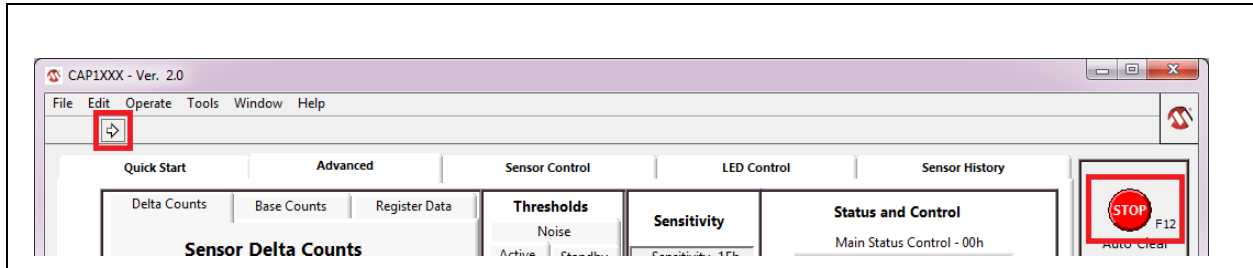

Figure 4.6 Run Button

To restart communications between the software and the evaluation board, click the Run button. The arrow button disappears when communications resume.

To close the program, use the red X in the upper right corner of the window.

4.5.2 Auto Clear INT

When the Auto Clear INT button is enabled (dark gray), the INT bit, ALERT pin, and status indicators are continuously cleared. When the Auto Clear INT button is disabled (light gray), the user must manually clear interrupts by clicking the INT indicator on the Status and Control Panel or the Auto Clear INT button. This is shown in Figure 4.5 at the top of the red highlighted box.

4.5.3 Deep Sleep Indicator

The Deep Sleep indicator located below the Auto Clear INT toggle switch in the upper right and shown in Figure 4.5, indicates whether the device is in the Deep Sleep state. During normal operation, this indicator is dark. When the device is placed into the Deep Sleep state, this indicator turns blue (or a lighter color, depending on the PC settings).

4.5.4 Update All Registers

The Update All Registers button shown in Figure 4.5, will update all values displayed on the GUI control panels to reflect the current device registers. In order to keep control panel response time reasonable, only a few of the device registers are read and continuously updated during normal operation. Clicking the Update All Registers button will automatically cycle refreshing all controls and readings on the control panel.

The keyboard shortcut is F7.

4.5.5   QuickLoad Buttons

The QuickLoad buttons, on the Panel shown in Figure 4.5, allow the user to quickly load configuration files (see Section 4.4, "Save/Load Tab").

There are five QuickLoad buttons available. Each button is linked to a ".txt" file in your installation directory that has the filename listed above the button. To link the button to a different file, type the filename (without the extension) in the box above the button, then click off the field. Figure 4.7 shows new names for the first two buttons. To load the file, click the button or press the shortcut key listed next to the button.

The 'Buttons' QuickLoad option will set up the CAP1xxx evaluation board for each sensor to behave as normal touch buttons. Due to the thin front cover of the evaluation boards, this means the gain is set to the lowest option, and the sensitivity option is greatly reduced from the maximum.

The 'Proximity' QuickLoad option will set up the CAP1xxx evaluation board for all of the sensors to detect the proximity of a hand approaching. The gain and sensitivity, in this case, are set very high. Using this configuration, you can see how the size of the sensors will affect the possible range of proximity detection.
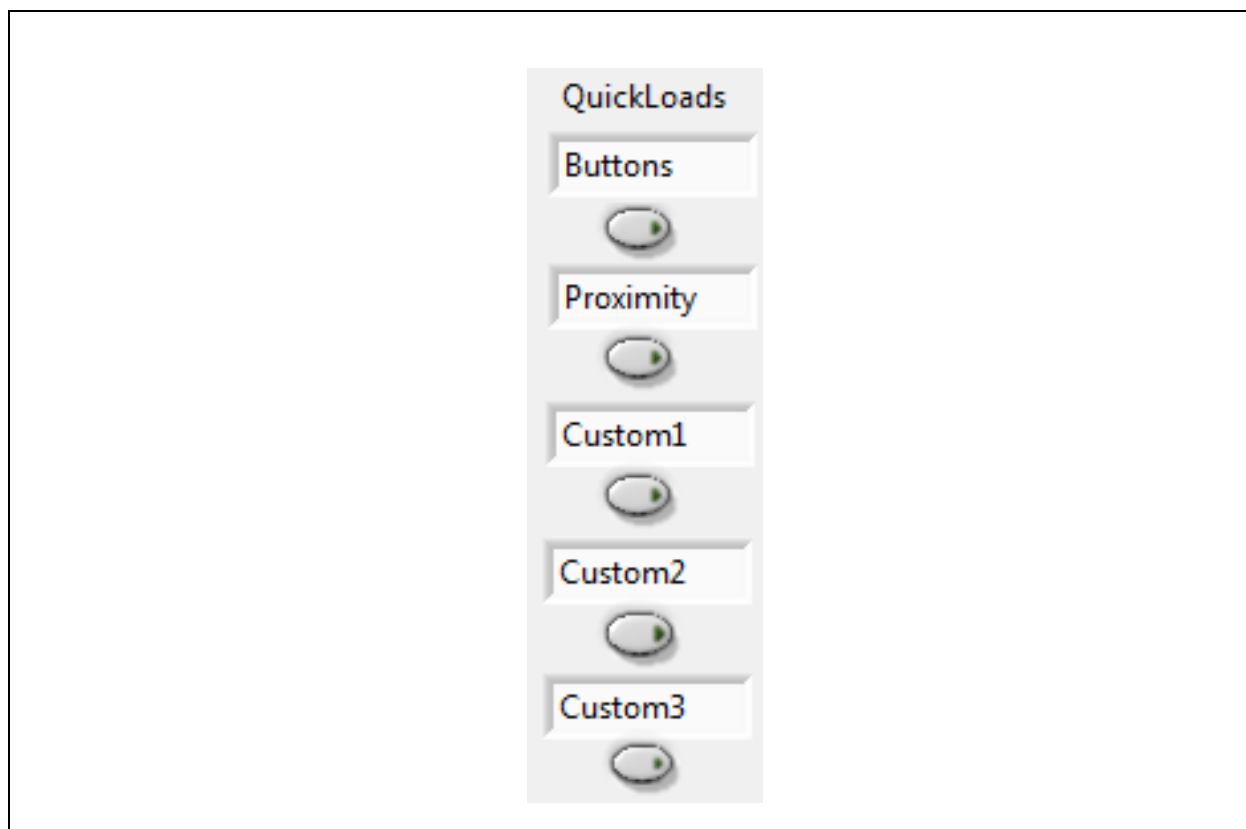

Figure 4.7 QuickLoad Buttons

4.5.6   Defaults Button

The Defaults button, toward the bottom of the red highlighted panel shown in Figure 4.5, loads the default register settings on the device as described in the datasheet.

The keyboard shortcut is F6.

4.5.7   COM Indicator

The COM indicator, toward the bottom of the Panel shown in Figure 4.5, indicates the status of communications over the I2C. During normal operation, the COM indicator is dark. If I2C communications fail, the COM indicator turns red.

4.5.8   I2C Address

I2C Address, at the bottom of the red highlighted panel shown in Figure 4.5, indicates the 2C address of the device.

4.6   Delta Counts Tab

The Delta Counts tab on the Main window and in the Quick Start window shown in Figure 4.8, displays the delta counts of the capacitive sensor channels. The Delta Count Register address for each sensor input is listed below the sensor number.
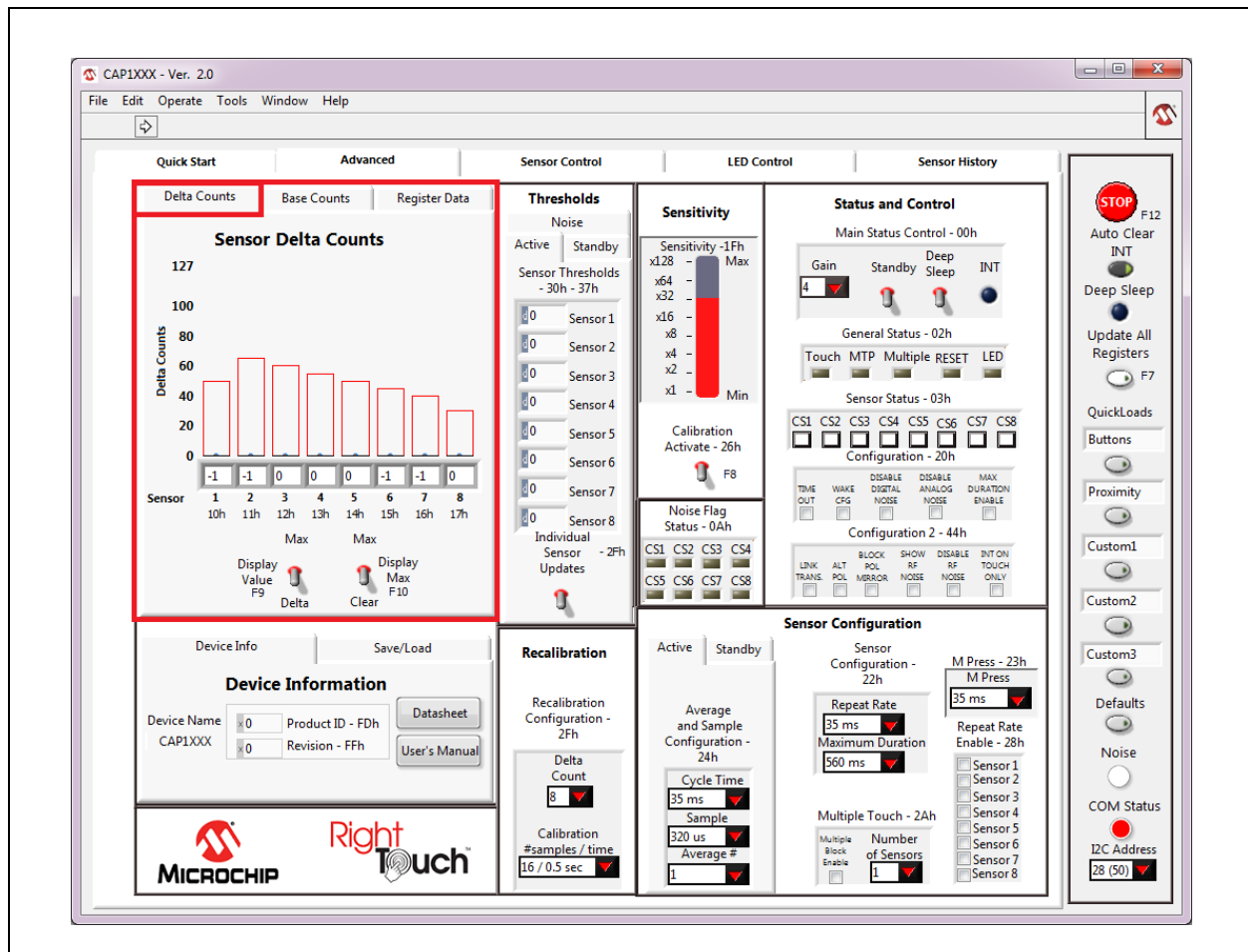
Figure 4.8 Delta Counts Tab

When the Display Value switch is set to Delta, the number cell below each indicator bar displays the least significant byte of that channel's current delta count. When the Display Value switch is set to Max,

the number cell below each indicator bar displays the max delta count for the channel (when the Max Enable switch is up). The outline on the top of each indicator bar shows the threshold of the sensor channel. As a sensor pad is being approached and touched, a black bar displays the actual delta count.

The Max Enable switch, when set in the upper position, turns on display of thin blue bars that indicate the maximum delta count for each channel. These bars display the maximum delta count until the Max Enable switch is set to the lower, "Clear" position.

Settings that control the threshold values are covered in Section 4.9, "Sensitivity Control Panel".

All numbers (except register addresses) on this tab are displayed in decimal format.

4.7   Base Counts Tab

The Base Counts tab on the Main window, shown in Figure 4.9, displays Base, Delta, Current Count, Calibration Factor, and Capacitance in a register format and includes a Sensitivity control. This tab can be used to check the sensors' calibration values.
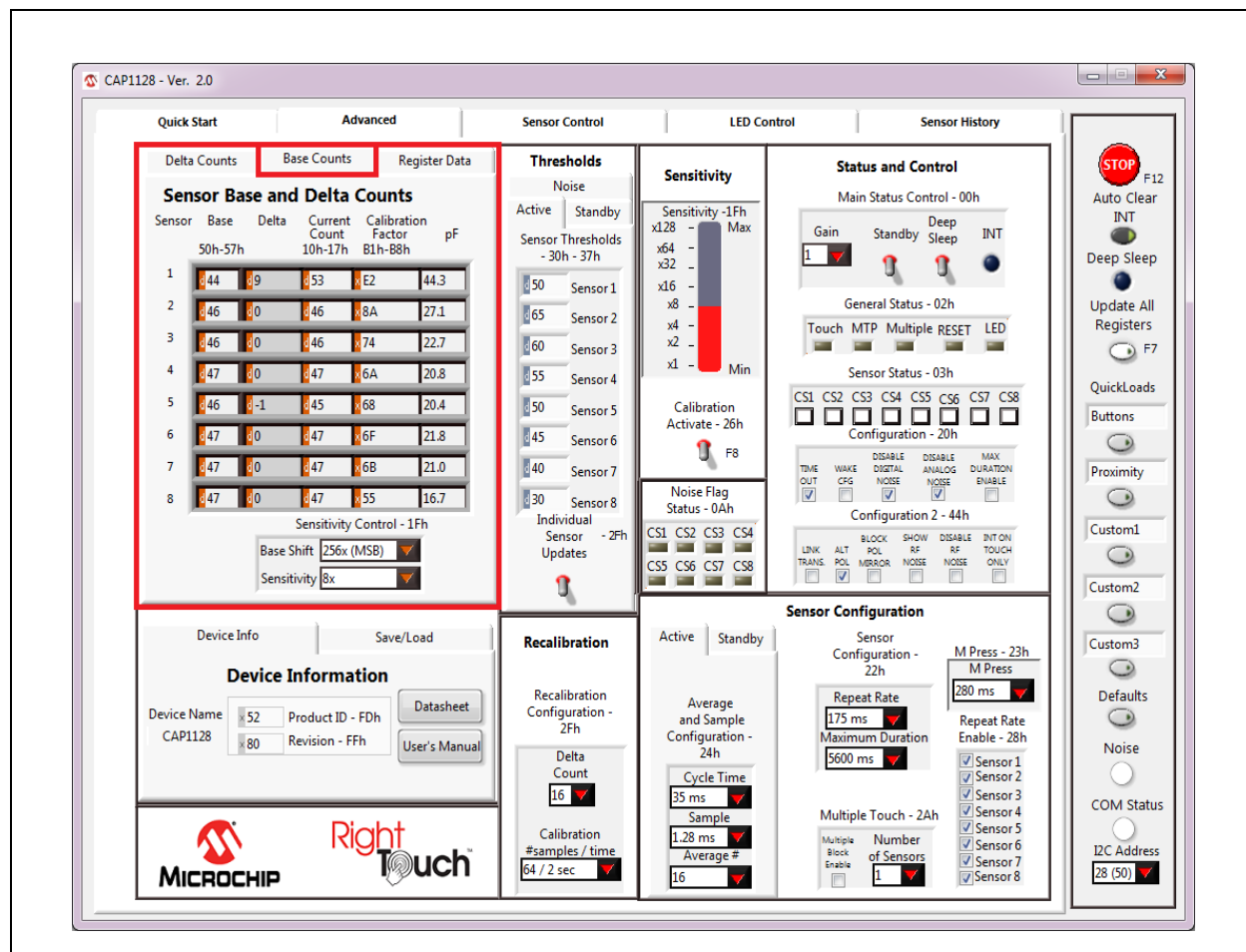
Figure 4.9 Base Counts Tab

The formats of values on this control panel can be changed to Hexadecimal, Octal, Binary or SI Notation by clicking the tap in the front of each data cell (see Section 4.2.1, "Numbering Systems Views").

The Sensitivity Control section affects the Sensitivity Control Register (1Fh). The Base Shift controls the scaling and data presentation of the Base Count registers. The higher the value of these bits, the larger the range and the lower the resolution of the data presented. It should not be necessary to modify this number.

The Sensitivity drop-down list allows update of the sensitivity multiplier, which controls sensitivity of a touch detection. This value can also be updated using the Sensitivity bar in the Sensitivity Control Panel (see Figure 4.11, "Sensitivity Control Panel").

4.8   Register Data Tab

The Register Data tab in the Advanced window shown in Figure 4.10, displays a list of all registers and allows the user to directly write to any register of the device.
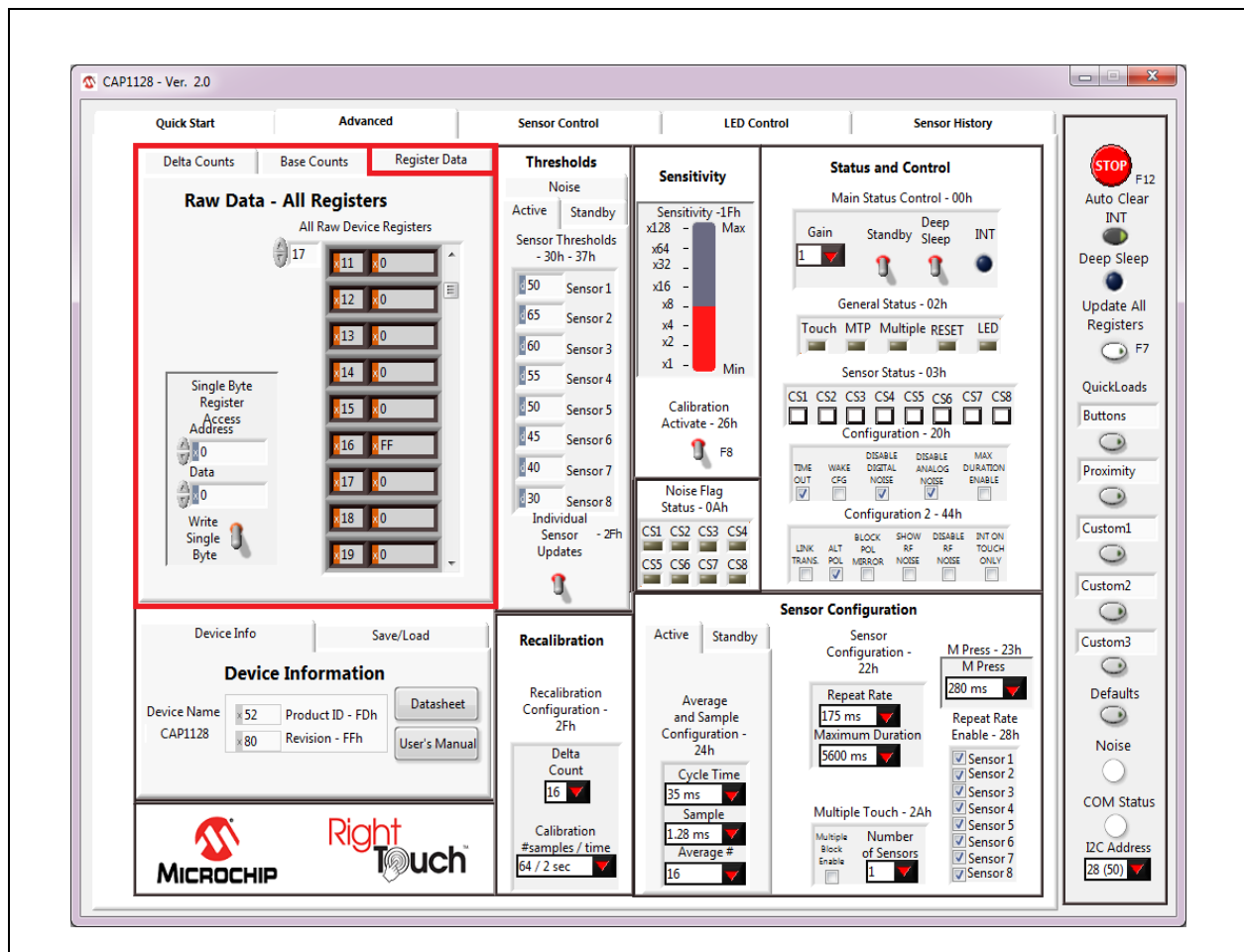
Figure 4.10 Raw Data Tab

The All Raw Device Registers display shows a scrollable list of registers and their current values. It is important to note that not all addresses are physical memory locations on the device; these registers will read "0". Likewise, some registers shown that are undocumented in the datasheet may have data.

Editing these registers can cause unexpected results. If a mistake is made while making a manual edit in this window, it may be necessary to revert to the defaults or a stored configuration.

The Single Byte Register Access control allows direct write to any register within the device.

The formats of address and data on this control panel are hexadecimal by default, with the option to change to Decimal, Octal, Binary or SI Notation (see Section 4.2.1, "Numbering Systems Views").

4.9   Sensitivity Control Panel

The Sensitivity Control Panel provides controls for capacitive sensor input sensitivity and on-demand calibration, as shown in Figure 4.11.
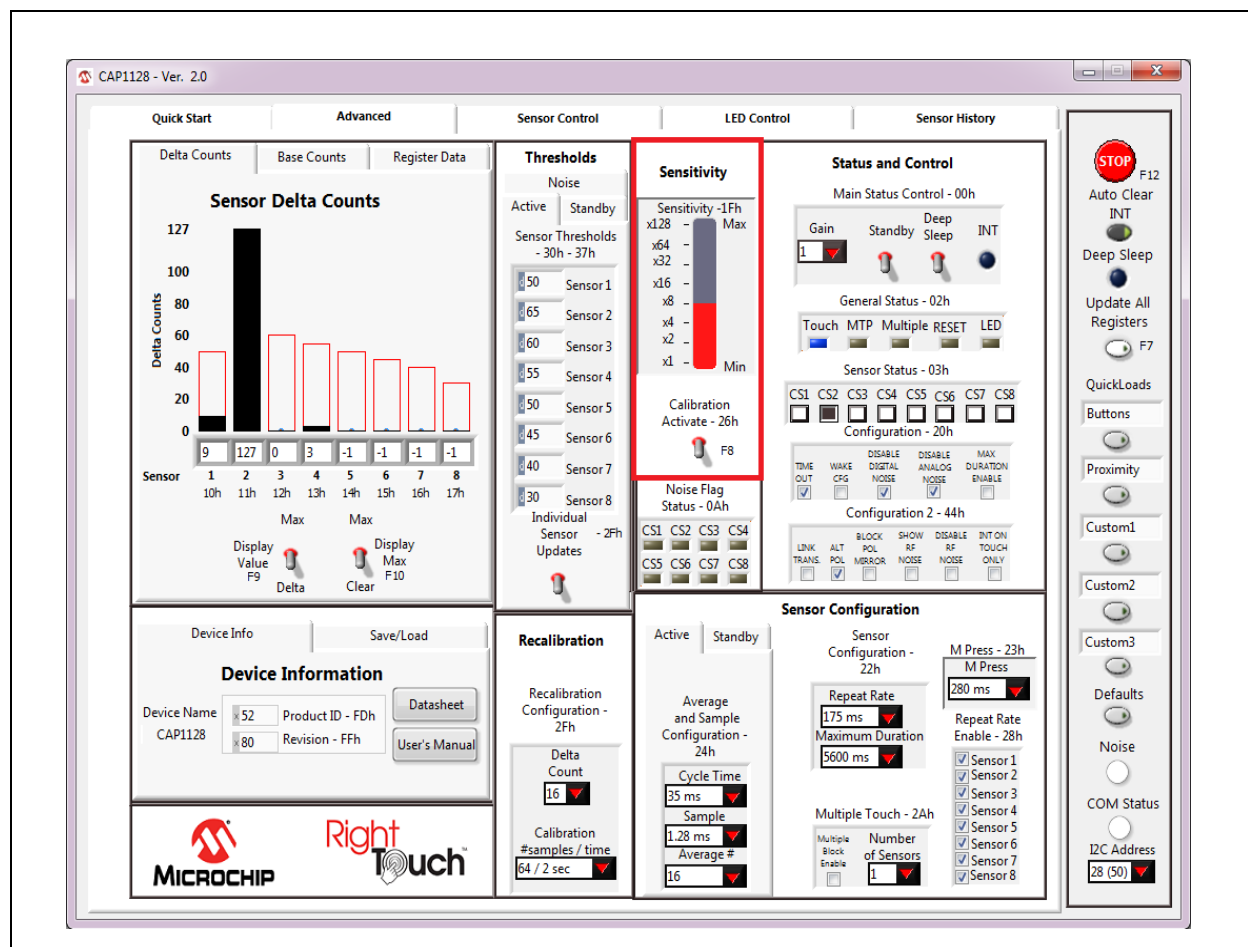
Figure 4.11 Sensitivity Control Panel

The Sensitivity bar affects the Sensitivity Control Register (1Fh), which controls the amount of capacitance change required to affect the sensor's signal.. Clicking the bar changes the setting. The value selected is also reflected in the Sensitivity cell on the Base Counts Tab.

Occasionally it is desirable to force recalibration of the sensor inputs. Clicking the Calibration Activate switch will recalibrate the sensor inputs.

Note: This is equivalent to writing 0xFF to the Calibration Activate register (26h).

4.10 Thresholds Control Panel

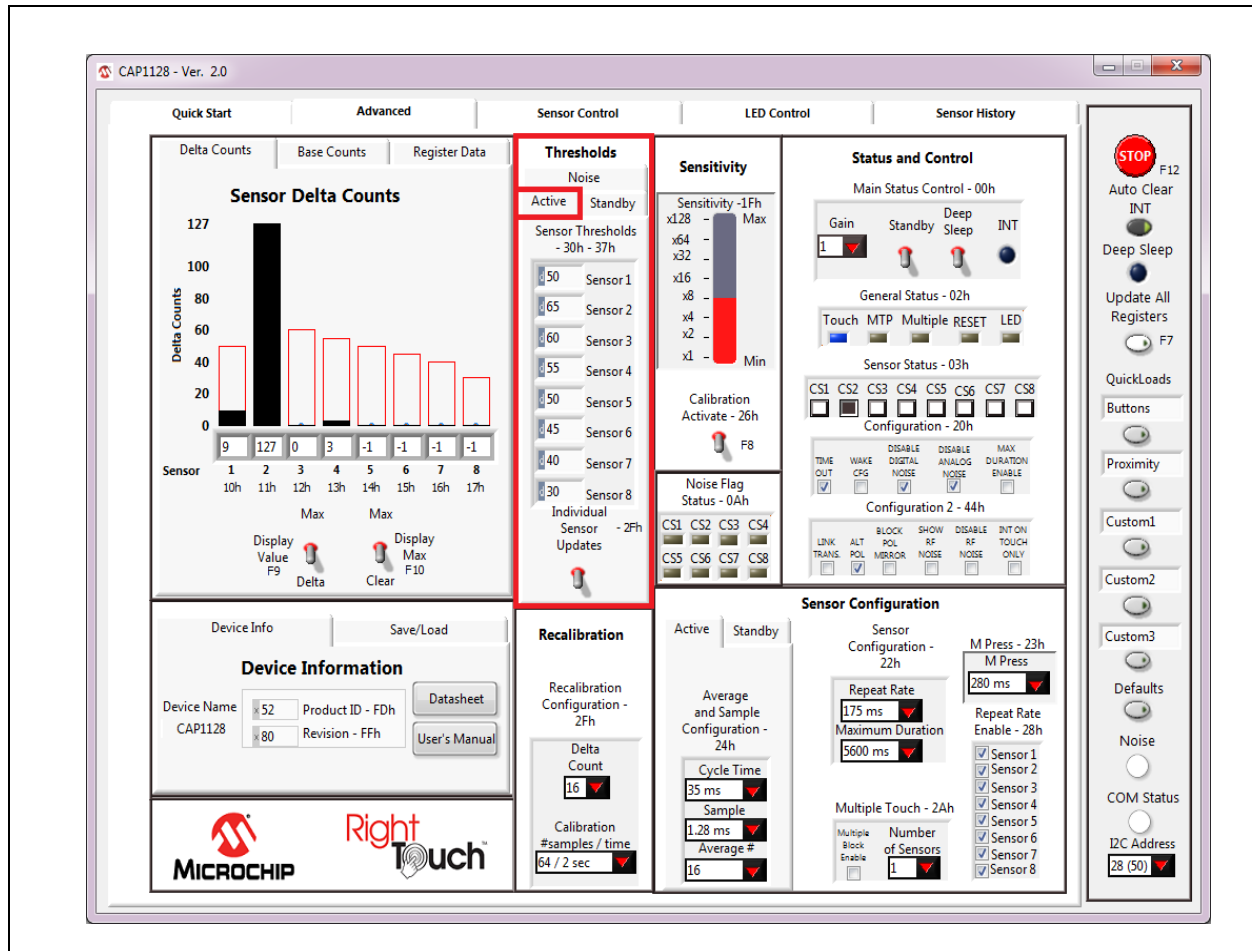The Thresholds Control Panel, shown in Figure 4.12, contains 4 tabs which are described below.

Figure 4.12 Thresholds Control Panel - Active Tab Displayed

4.10.1 Active Tab

The Active tab of the Advanced window's Thresholds section, shown in Figure 4.12, contains the sensor input thresholds (registers 30h - 37h) that define the delta count level at which touches are reported when the device is in the Fully Active state.

To quickly set all Active tab sensor input thresholds to the same value, ensure the 'Sensor 1 Updates All' switch is in the up position, enter the desired value into the Sensor 1 data cell, and then click out of the cell. To individually set Active tab sensor input thresholds, click the 'Sensor 1 Updates All' switch so it's in the down position and displays the label "Individual Sensor Updates".

4.10.2 Standby Tab

The Standby tab of the Advanced window's Thresholds section shown in Figure 4.13, contains sensor input controls for the Standby power state.
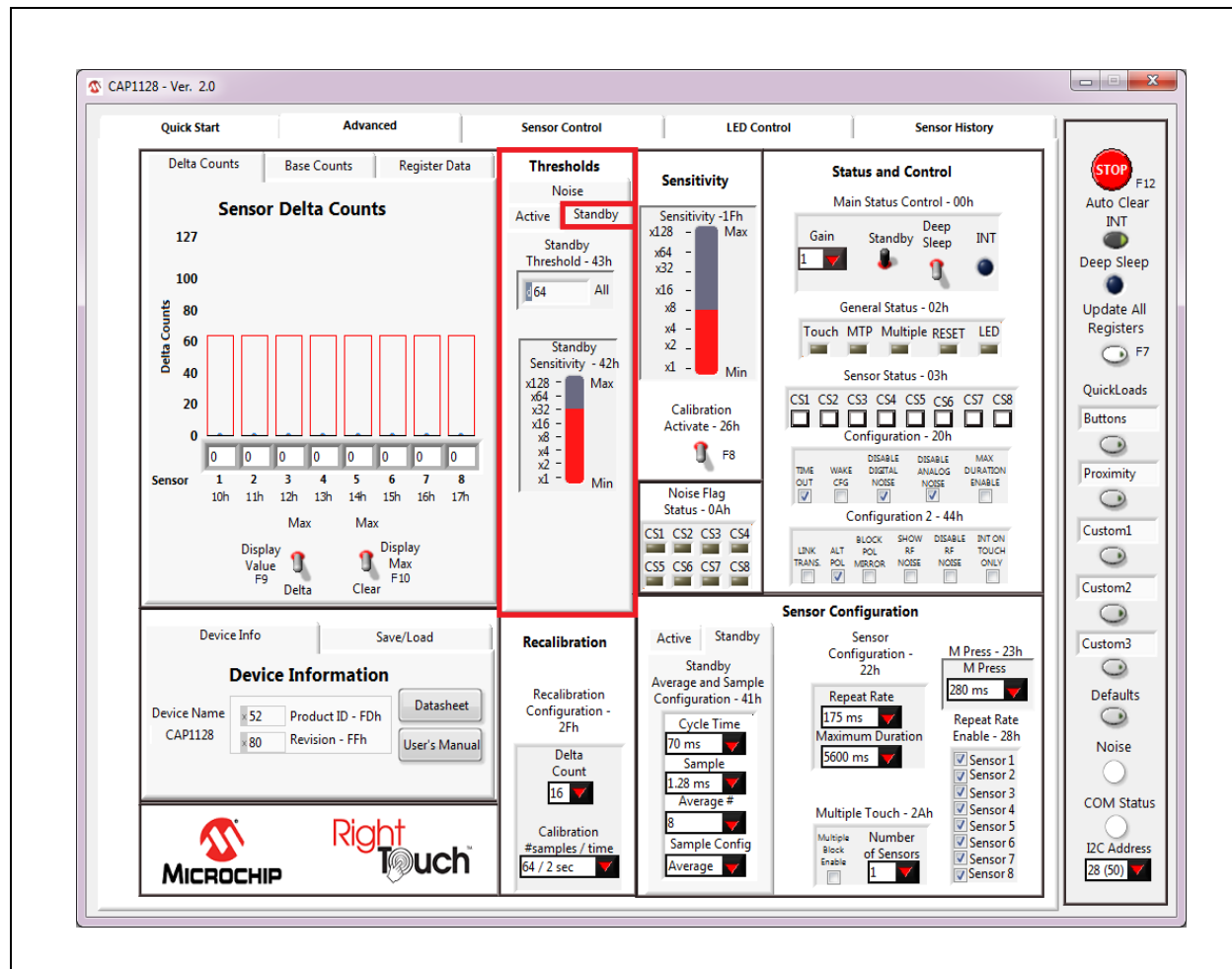
Figure 4.13 Thresholds Control Panel - Standby Tab Displayed

The Standby Threshold defines the delta count threshold level for all sensor inputs when the device is in the Standby state. There is also a Standby Sensitivity bar that affects the Standby Sensitivity Register (42h).

4.10.3   Noise Tab

The Noise tab of the Main window's Thresholds section shown in Figure 4.14, contains the threshold used to detect noise. The Sensor Noise Thresholds are a percentage of the Sensor Thresholds on the Active tab.
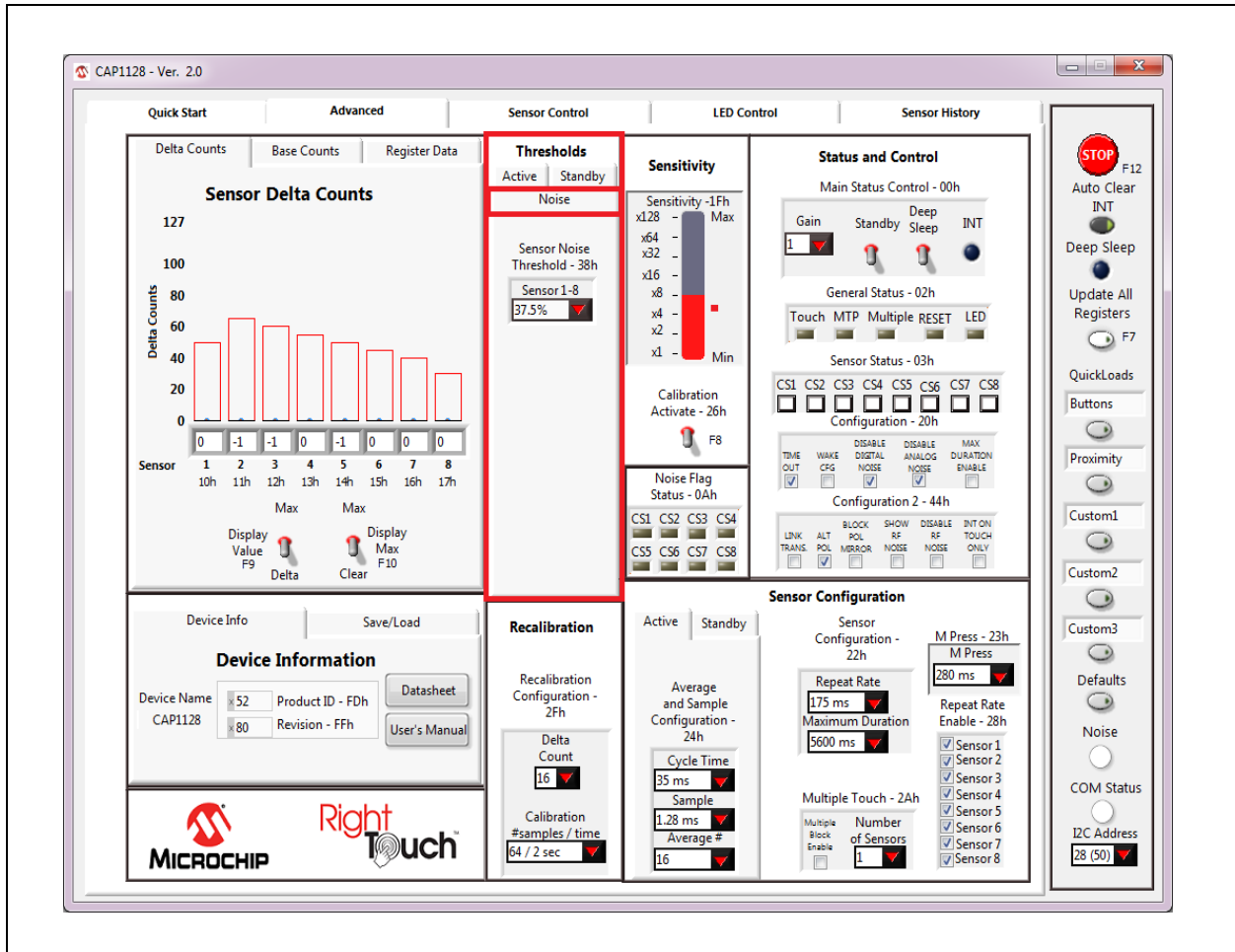

Figure 4.14 Thresholds Control Panel - Noise Tab Displayed

4.11 Recalibration Configuration Control Panel

On the Advanced window below the Thresholds section is the Recalibration Configuration section shown in Figure 4.15.
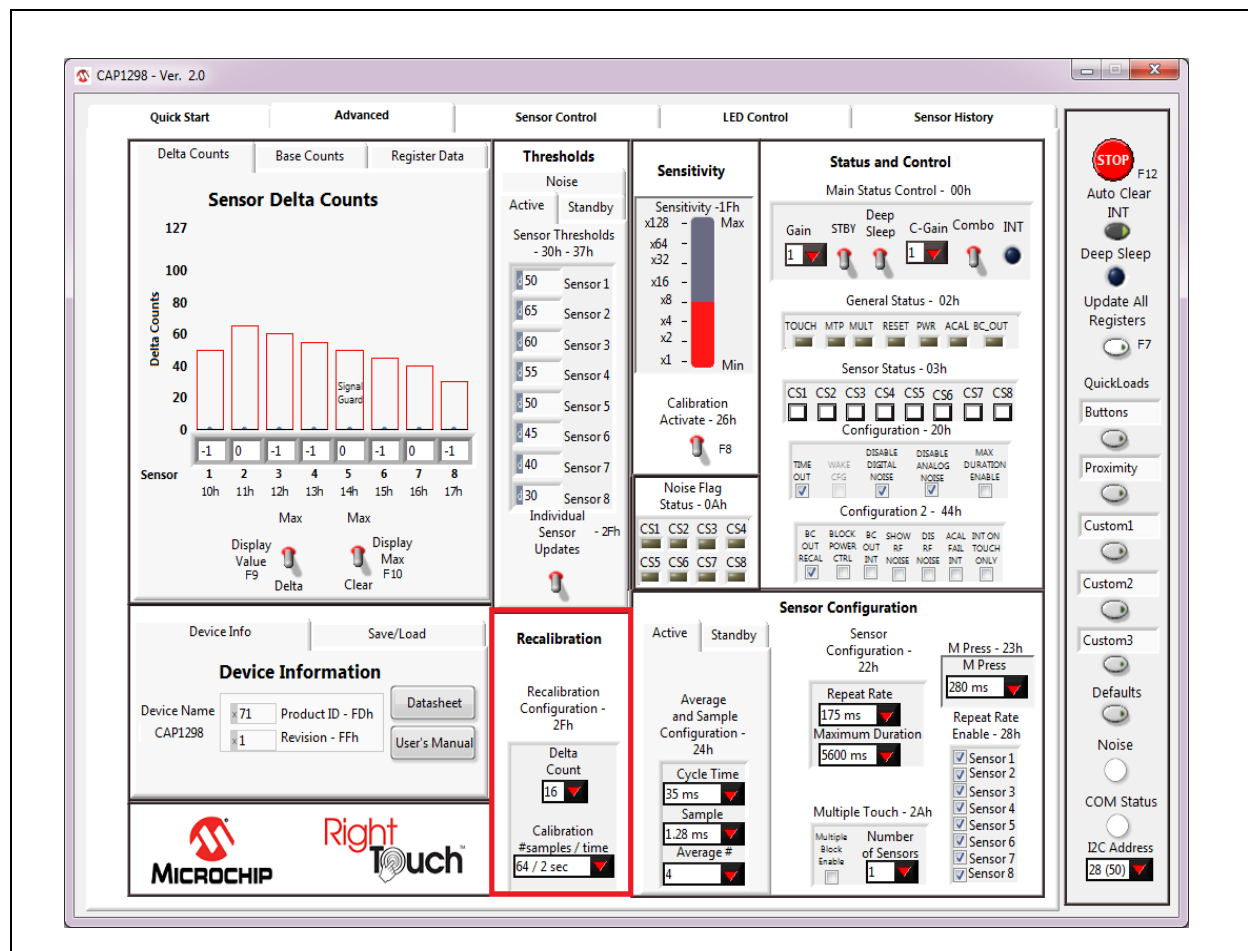
Figure 4.15 Recalibration Configuration Control Panel

The 'Calibration #samples / time' drop-down menu allows selection of the update time and number of samples related to the recalibration routine. Negative delta count allows selection of the number of consecutive negative delta counts necessary to trigger a digital recalibration. Both of these controls affect the Recalibration Configuration Register (2Fh).

4.12 Status and Control Panel

The Status and Control section of the Main window shown in Figure 4.16, displays the current Sensor Status register value and the General Status register. It also provides control and display of the device interrupt, power states, and advanced configuration options.
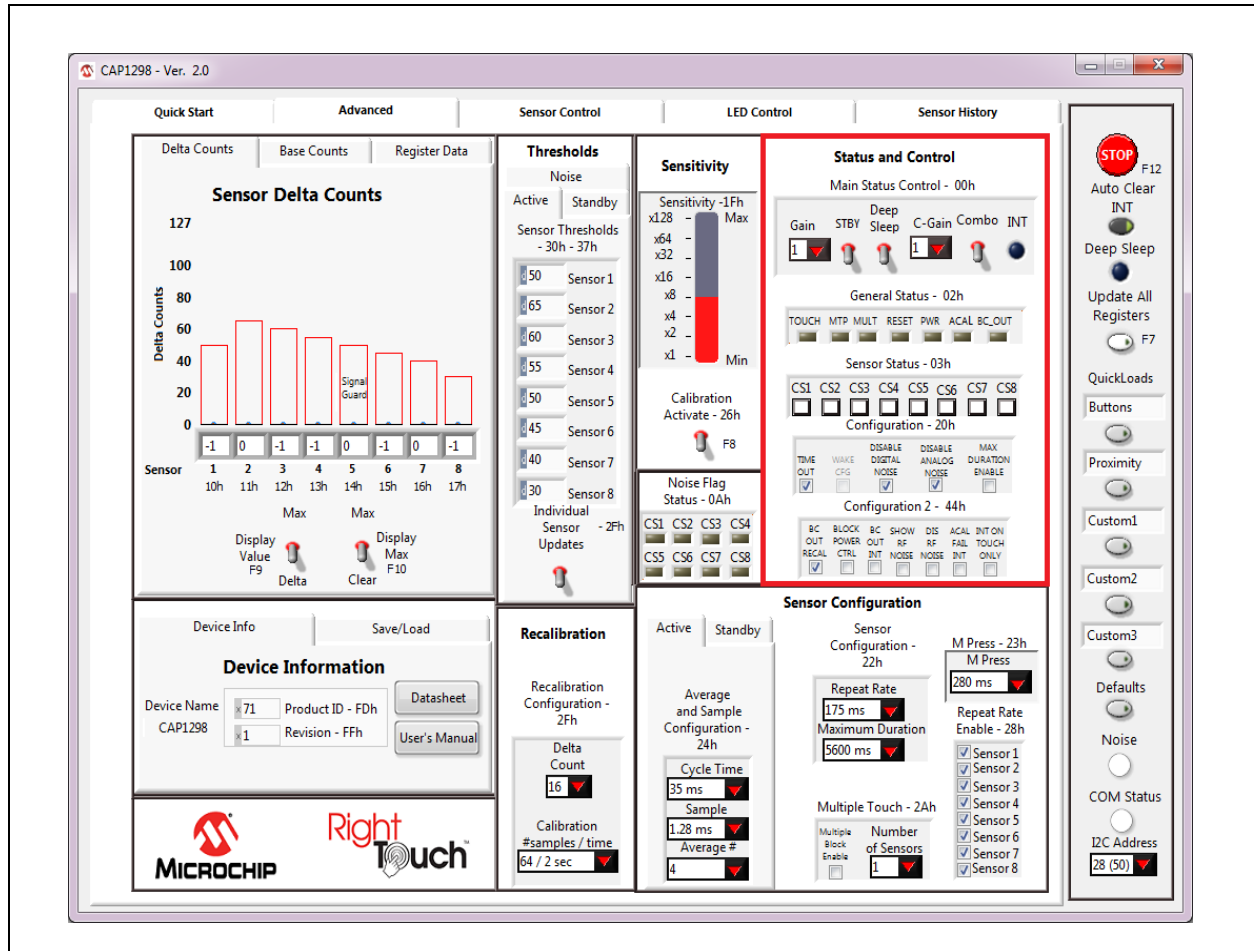
Figure 4.16 Status and Control Panel

When the sensor's signal exceeds the threshold, the Sensor Status section will change the corresponding square button to a dark square. Depending on configuration settings, indicators in the General Status section may turn blue (or a lighter color, depending on the PC settings) when the criteria for the indicator is met.

If the Auto Clear INT button on the Panel (see Section 4.5, "Communications Status and Control Panel") is enabled (dark gray), the INT indicator, General Status section, and the Sensor Status section are continuously cleared. This allows the user to see only the current state of the device.. If the Auto Clear INT button is disabled (light gray), the user must manually clear interrupts by clicking the INT indicator or the Auto Clear INT button. This allows for a more realistic demonstration of the behavior of the device's registers between host reads and writes of the INT bit.

4.12.1 Power States

Please refer to the device datasheet for details regarding the different power states. The software switches work as follows:

■ The Standby switch toggles between the Standby and Fully Active states.

■ The Deep Sleep switch puts the device into the Deep Sleep state. To exit Deep Sleep, click anywhere on the GUI to display the message shown in Figure 4.17. There is also a timeout that will display the message shown in Figure 4.18.
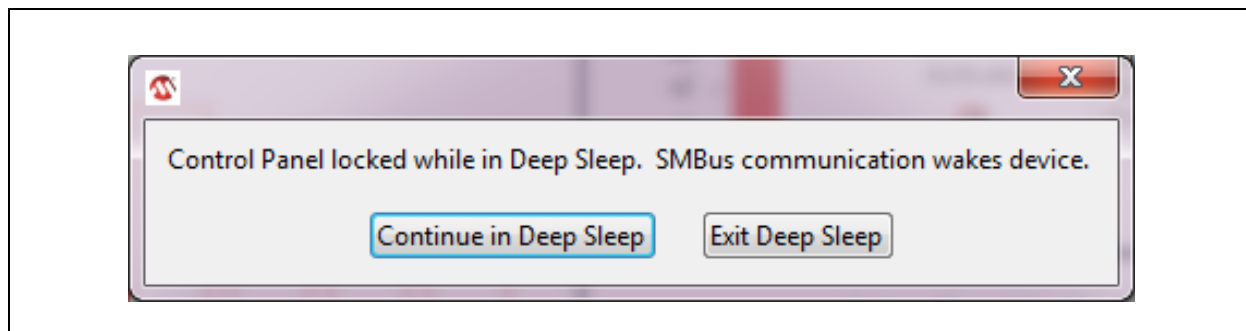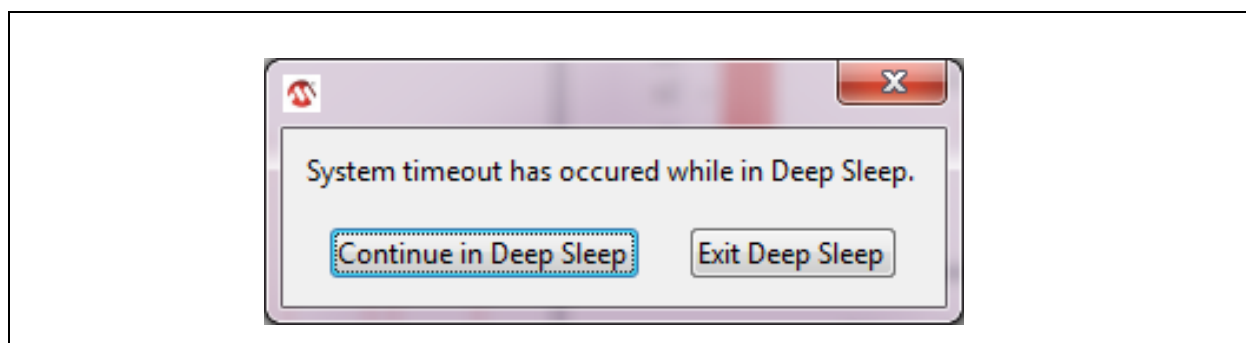

Figure 4.17 Deep Sleep Message

Figure 4.18 Deep Sleep Timeout Message

4.12.2 Configuration and Configuration 2

The Configuration section of 'Status and Control' allows the user to enable and disable bits in the Configuration Register (20h). The Configuration 2 section allows the user to enable and disable bits in the Configuration 2 Register (44h). These registers control the general global functionality of the device. Refer to the datasheet for details.

4.13 Sensor Configuration Control Panel

The Sensor Configuration section shown in Figure 4.19, allows the user to adjust the configuration registers for the sensors. These controls change the response of the sensors to suit the environment, application, and desired response in the Fully Active and Standby states.
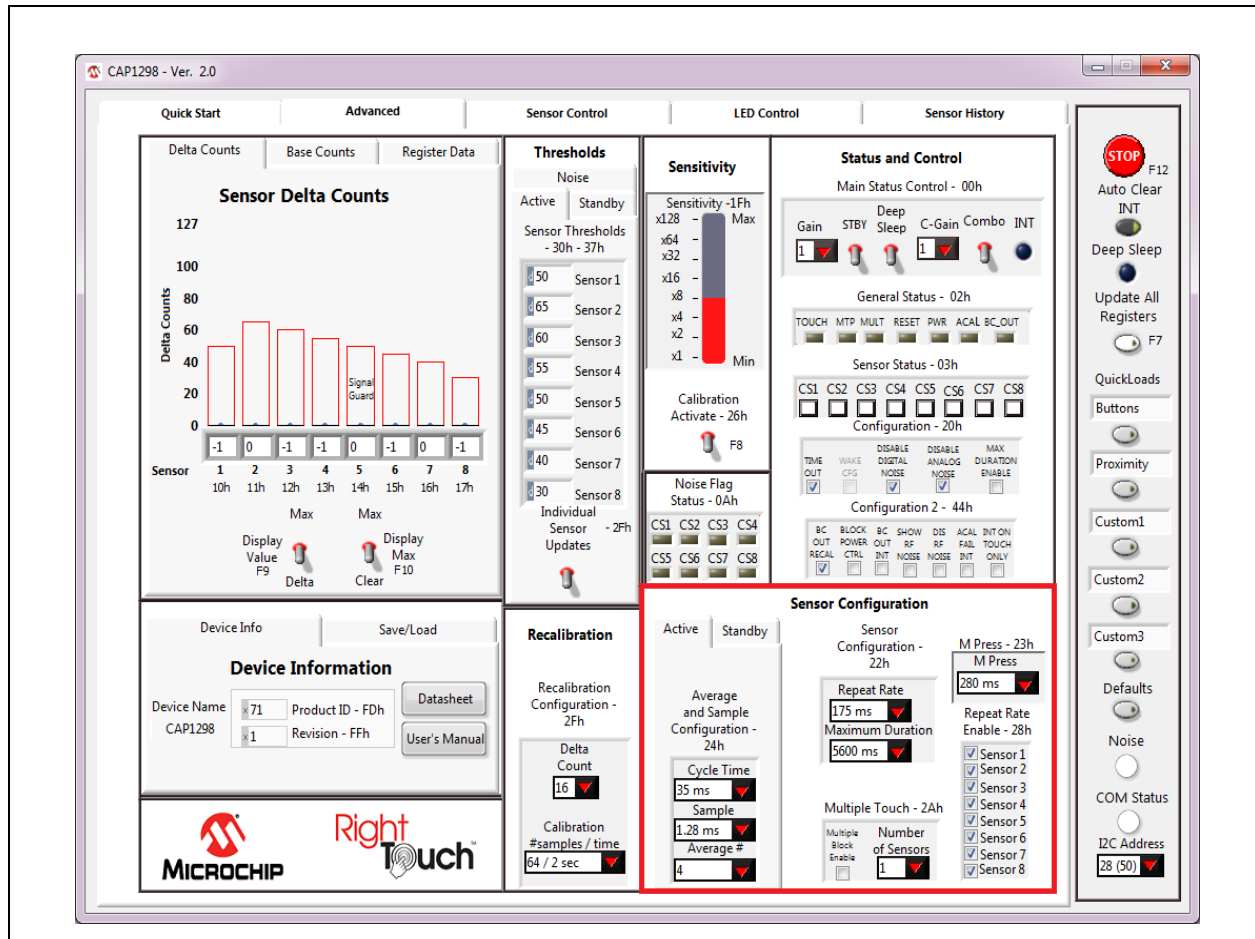

Figure 4.19 Sensor Configuration Control Panel

The Sensor Configuration section contains options for the Averaging and Sampling Configuration Register (24h), which adjust the averaging and cycle time for sensor inputs that are active in the Fully Active state. The Standby Tab controls affect the Standby Configuration Register (41h), which controls averaging and cycle time for sensor inputs that are active in the Standby state.

Controls in the Sensor Configuration section affect the Sensor Configuration Register (22h). Repeat rate settings determine whether one or more interrupts are sent per sensor activation and the duration between interrupts. Maximum duration settings determine maximum time a sensor can be activated before the sensor input is recalibrated.

The M Press control affects the Sensor Configuration 2 Register (23h). The M Press setting delineates the time duration difference between a touch versus a press-and-hold event. If the press is longer than the M Press time, it is considered a press-and-hold.

Controls in the Multiple Touch section affect the Multiple Touch Configuration Register (2Ah). Multiple touch settings determine how simultaneous touches to multiple buttons .are handled. Remember to check the 'Multiple Block Enable' box to enable this feature. In the actual device, the 'enable' bit must also be set in the register to enable the feature.

Controls in the Repeat Rate Enable section affect the Repeat Rate Enable Register (28h). When checked, the repeat rate defined in the Sensor Configuration section is enabled for the button.

5 GUI Sensor Control Tab

The Sensor Control tab provides the detailed controls for individual sensor inputs. Figure 5.1 shows the default view for the CAP1298 Evaluation Board.
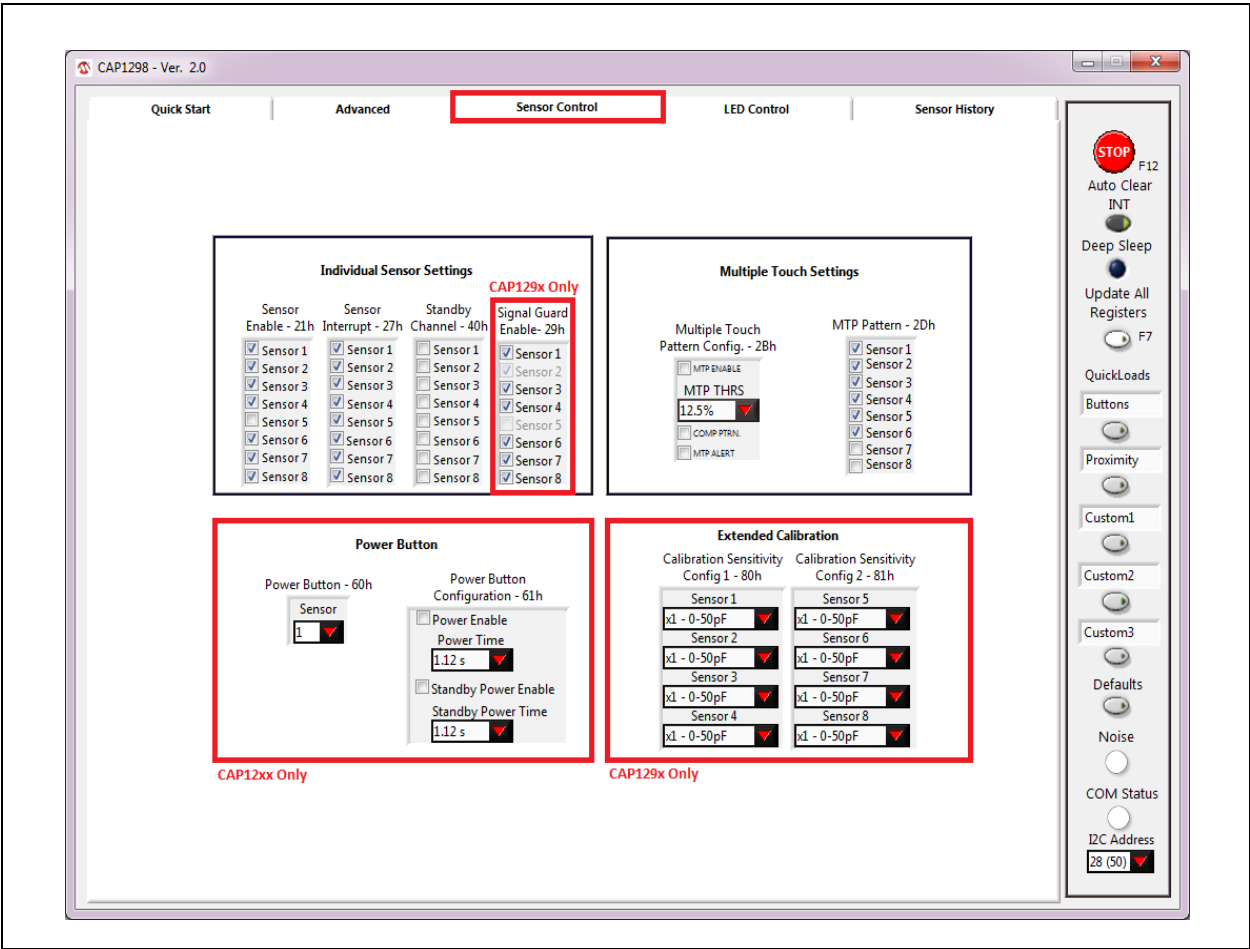
Figure 5.1 Sensor Control Tab for the CAP1188 Evaluation Board

The Sensor Control Panel has 2 sections: individual sensor inputs (see Section 4.1) and all sensor inputs (see Section 5.1).

5.1   All Sensor Input Settings

The All Sensor Settings display, shown in Figure 5.2, has the controls for all the sensor inputs. A check mark represents a '1' in logic.

The 'Sensor Enable' column determines which sensors are scanned in Active mode.

The 'Sensor Interrupt' column determines which sensors produce an interrupt when a touch is detected.

The 'Standby Channel' column determines which sensors are scanned in Standby mode. For the CAP12xx devices, this also determines which sensors will be scanned using the Combo Gain settings when in Combo mode.

The 'Signal Guard Enable' column is only available on CAP129x devices and determines which sensors will have the signal guard enabled during their scan.
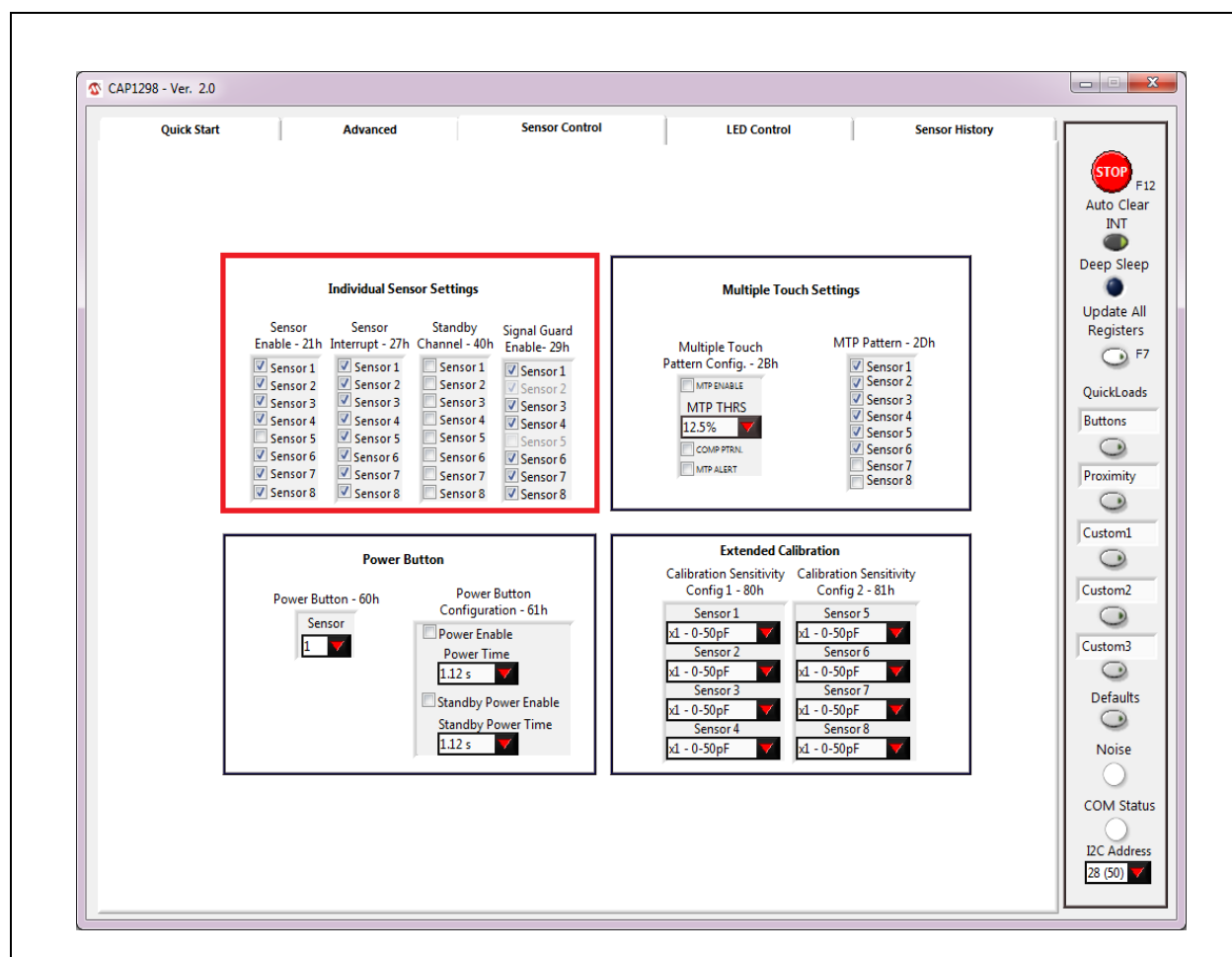
Figure 5.2 All Sensor Settings

5.2 Multiple Touch Pattern Settings

5.2.1 MTP Tab

The MTP tab of the Main window's Thresholds section shown in Figure 5.3, contains multiple touch pattern configuration controls. The MTP Thresholds are a percentage of the Sensor Thresholds on the Active tab.
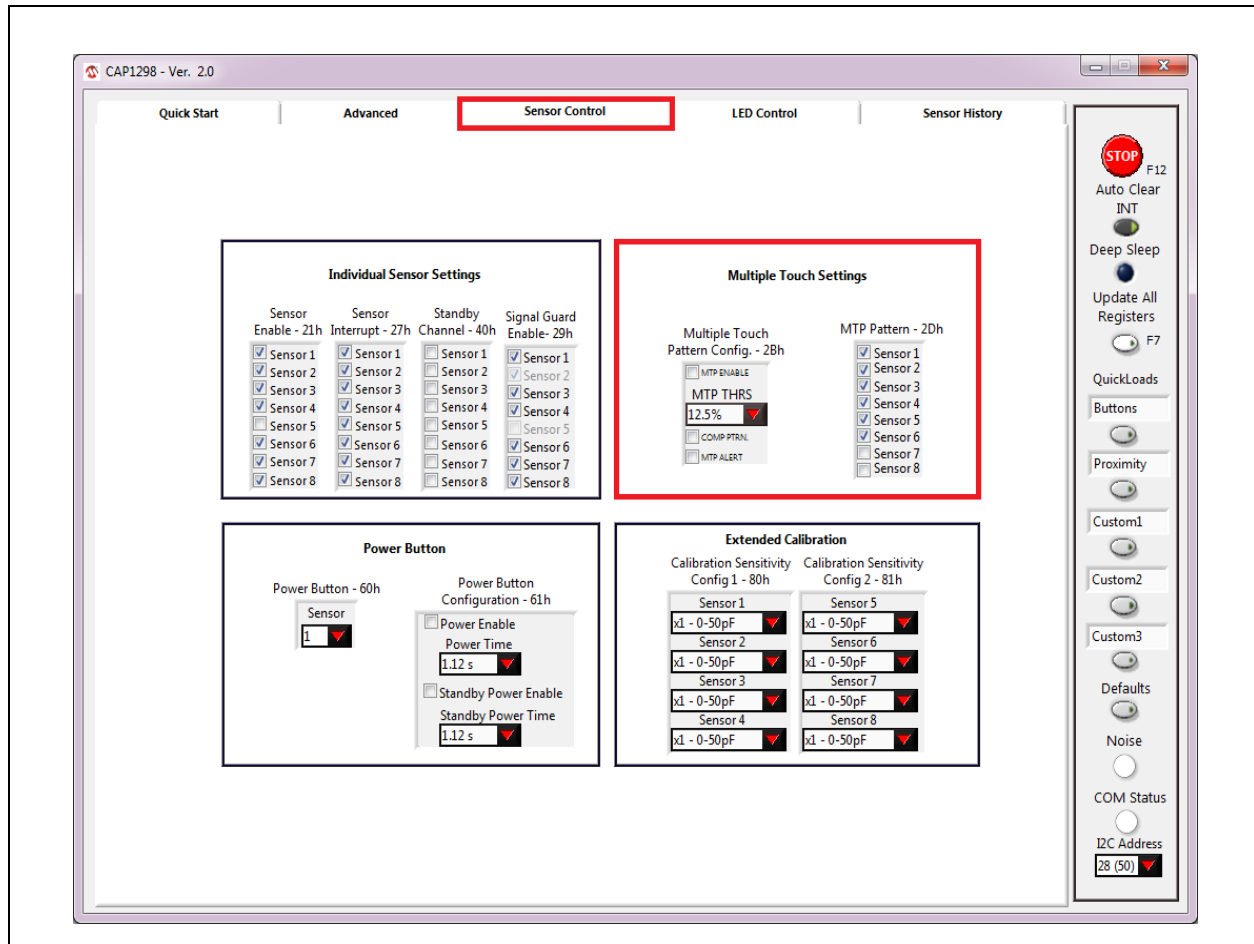
Figure 5.3 Multiple Touch Pattern Options

5.3 Extended Calibration Ranges

When using a CAP129x device, the Sensor Control window will display an Extended Calibration section, shown in Figure 5.1, for choosing the calibration sensitivity settings for each sensor. This allows the user to reduce the internal capacitance used while generating the sensing waveform (which will increase sensitivity), but the sensor must fall within the selected capacitance range or it will not calibrate.

5.4   Power Button

When using a CAP12xx device, the Sensor Control window will display a Power Button section, shown in Figure 5.1, for enabling a sensor to have a delay before registering a press. This allows systems to force the user to press for an extended period to verify that a critical action was meant to be performed. For example: if this is used to power on and off the application, setting a minimum press period with these options minimizes the chance of a user accidentally pressing the sensor.

6 GUI LED Control Tab

The LED Control tab provides the detailed controls for the LEDs. Figure 6.1 shows the default view for the CAP1188 evaluation board.

The CAP12xx devices do not have LED drivers, so this window will not contain any options. The LEDs on the evaluation board are being driven by the PIC16F145x microcontroller.an EVB using the CAP1188 device.
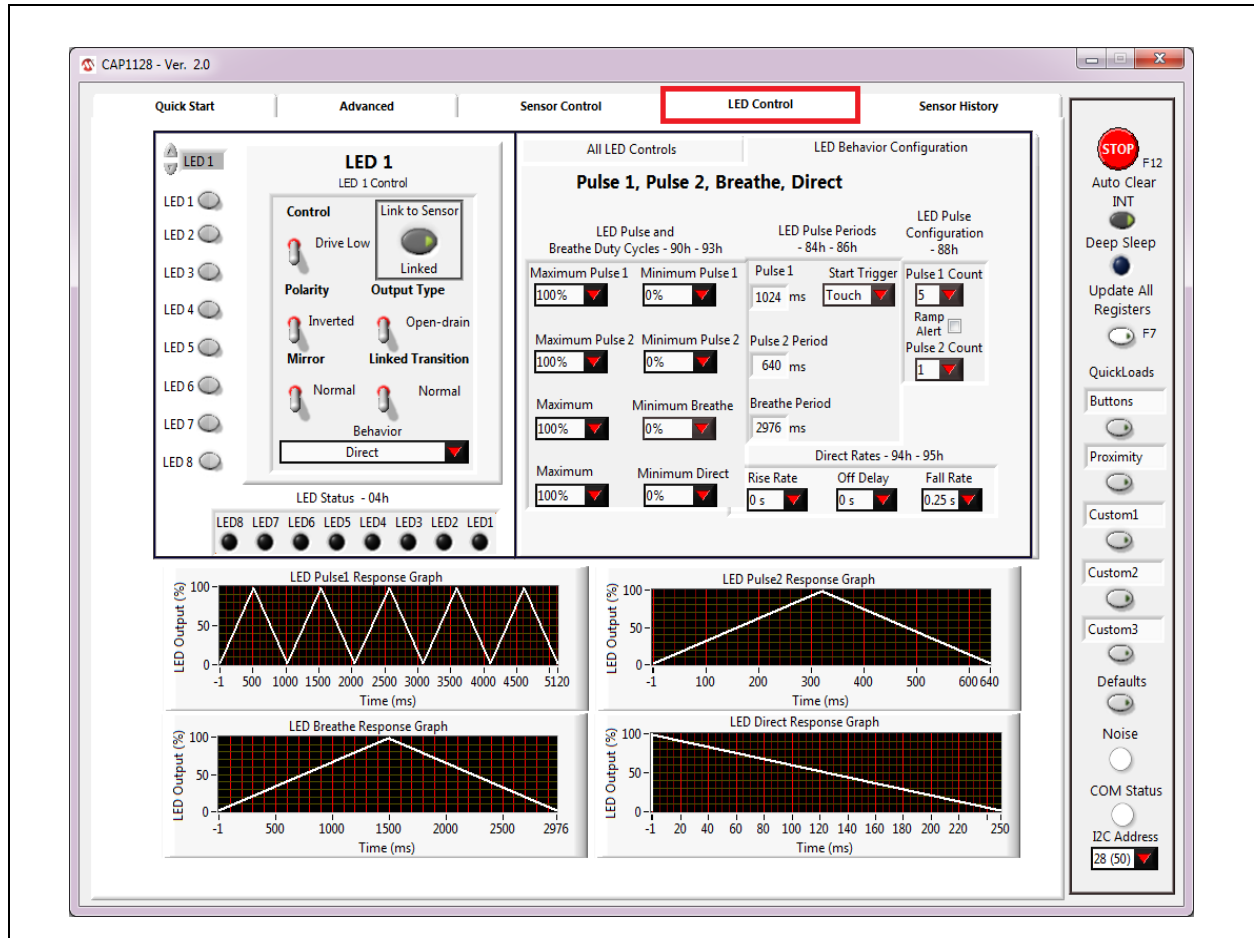
Figure 6.1 LED Control Tab for the CAP1188 Evaluation Board

The LED Control Panel has 3 sections: individual (see Section 6.1), all (see Section 6.3), LED behavior configuration (see Section 6.4), and graphs.

6.1   Individual LED Settings

To access individual LED controls, click the respective LED button on the left side of the control panel or use the scroll switch above the buttons. The control panel will then display controls for the selected LED. Figure 6.2 shows the control panel after the 'LED 1' button was clicked.
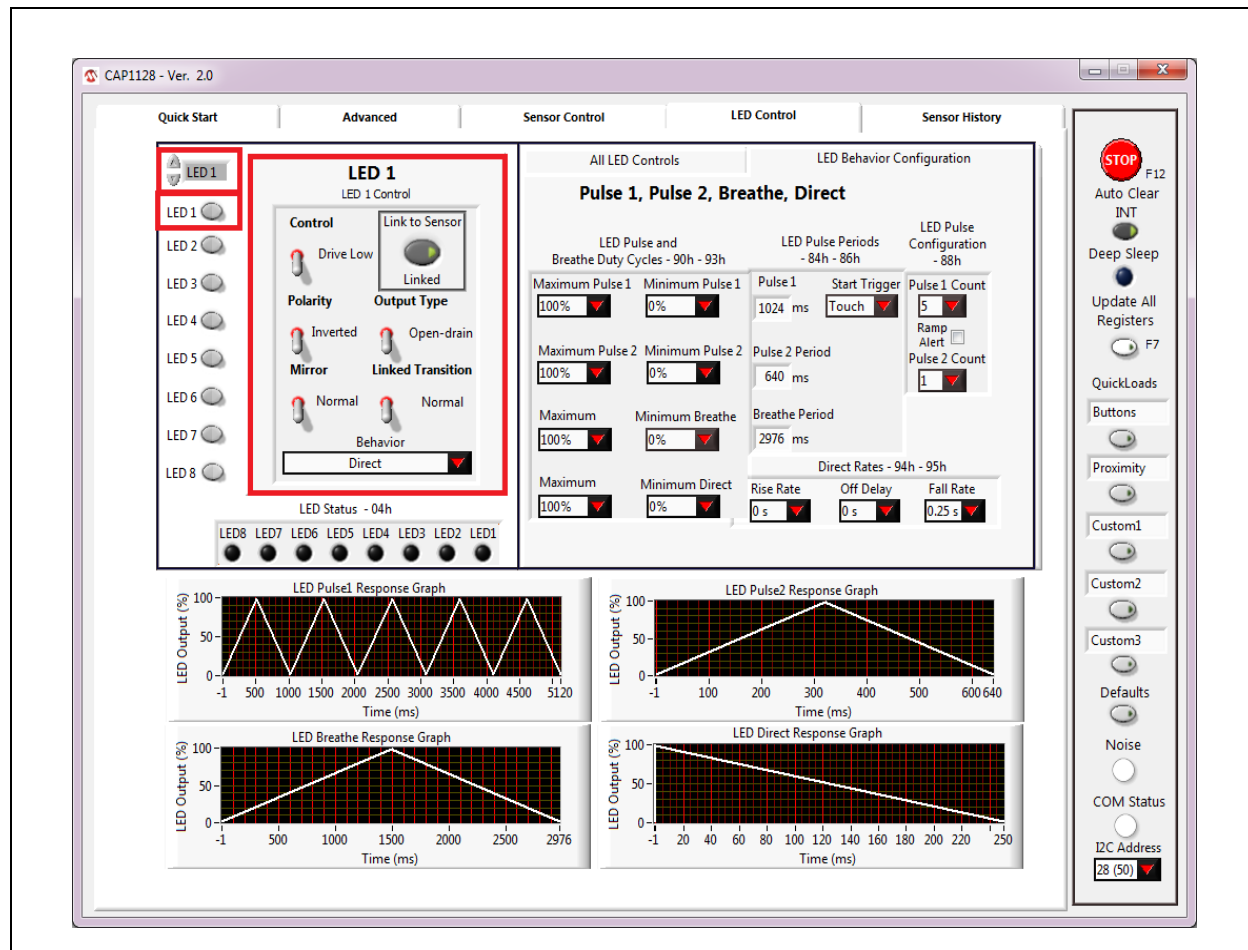
Figure 6.2 Individual LED Settings

6.2 LED Status

An indicator in the LED Status section changes color when the LED behavior has completed its cycle and the LED is in host control mode. The indicator for an LED is disabled when the LED is linked to a sensor.

If the Auto Clear INT button on the Panel (see Section 4.5, "Communications Status and Control Panel") is enabled (dark gray), the LED Status indicators are continuously cleared. If the Auto Clear INT button is disabled (light gray), the user must manually clear interrupts by clicking the Auto Clear INT button or the INT indicator on the Main Tab (Section 4.12, "Status and Control Panel").

6.3   All LED Settings

The 'All LED Settings' display, shown in Figure 6.3, displays a view of the LED controls for all the LEDs. A check mark represents a '1' in logic.

Note: This control panel does not include LED behavior. Use the individual settings panels instead.
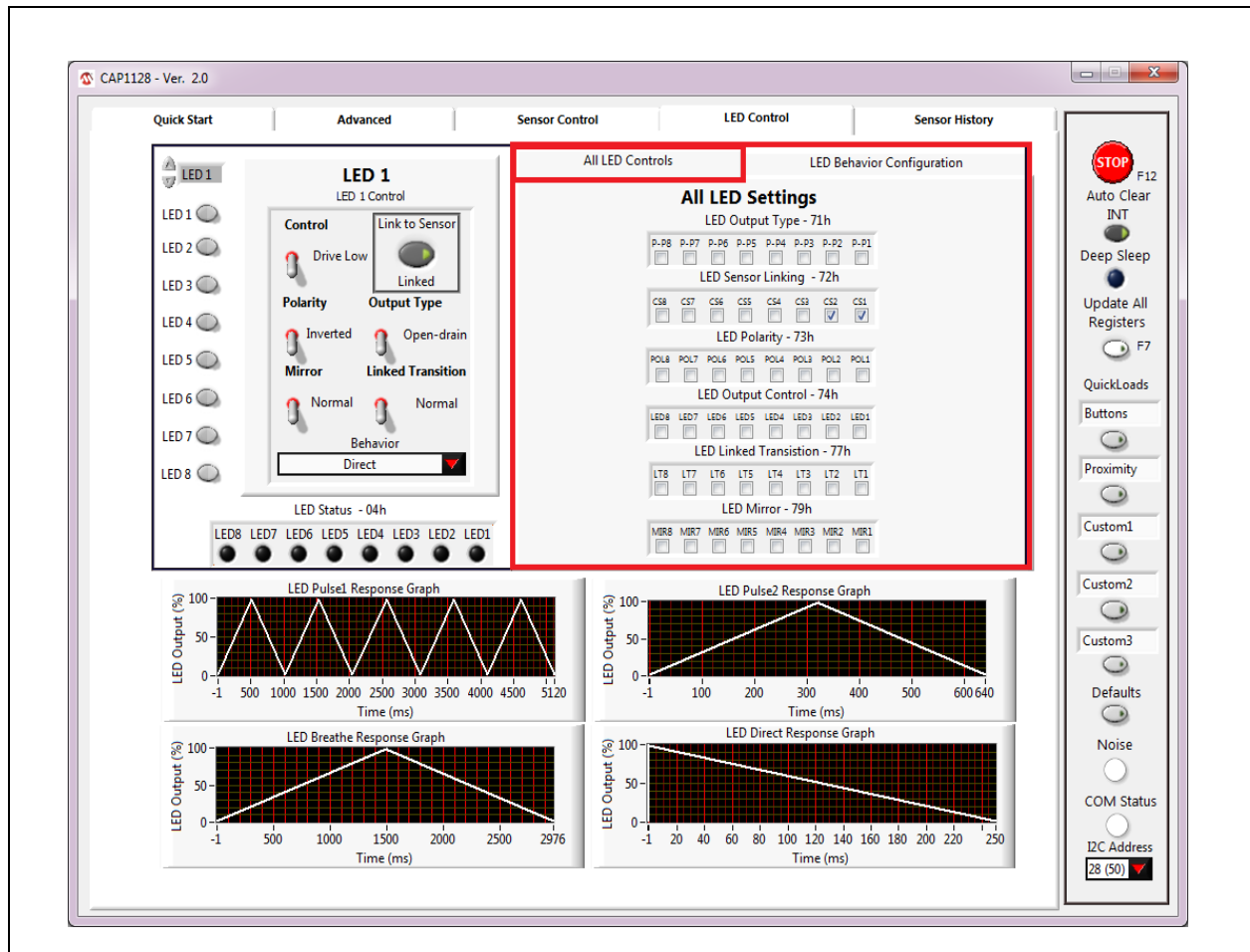
Figure 6.3 All LED Settings

6.4   LED Behavior Configuration Control Panel

The LED Behavior Configuration Control Panel, shown in Figure 6.4, provides controls for the 4 different types of behaviors available to the LED drivers.
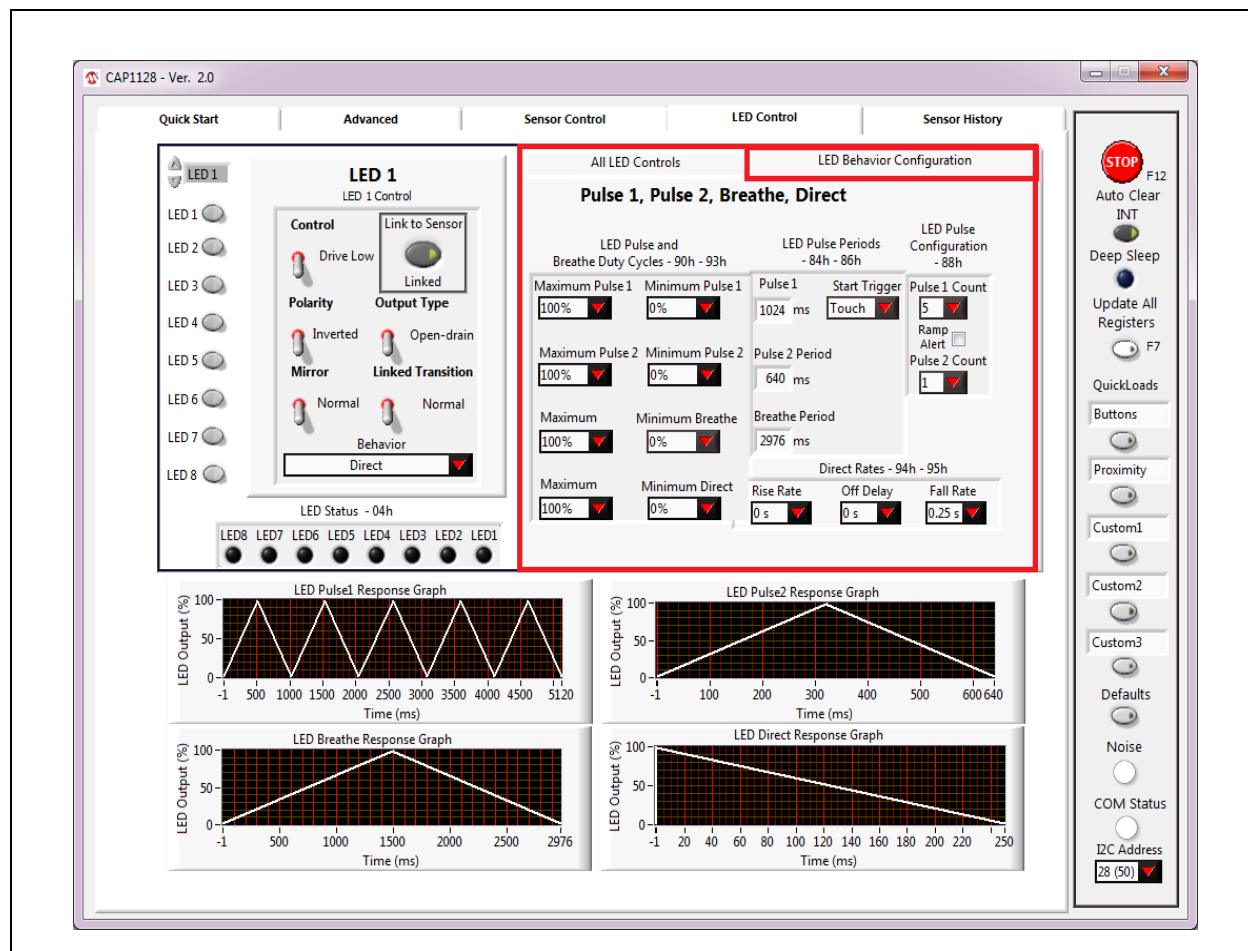
Figure 6.4 LED Behavior Configuration Control Panel

The graphs, shown in Figure 6.5, at the bottom of the LED Control tab display of how the behaviors will look based on the selections.
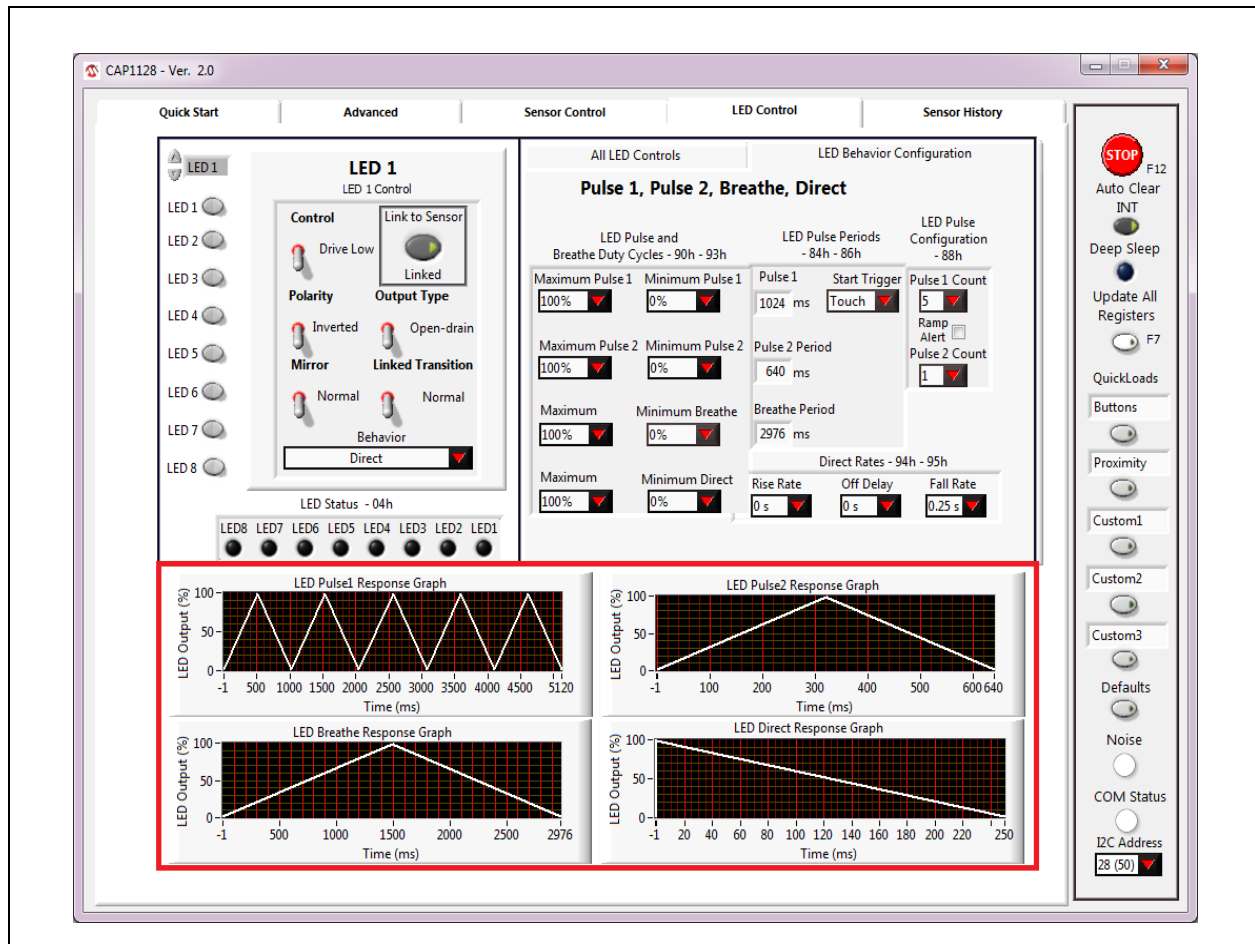
Figure 6.5 LED Behavior Configuration Graphs

Controls in the LED Pulse and Breathe Duty Cycles section affect the LED Duty Cycles Registers (90h - 93h). Controls in the LED Pulse Periods section affect the LED Period Registers (84h - 86h). Controls in the LED Behavior Configuration section affect the LED Configuration Register (88h).

The LED Pulse1 Response Graph reflects the settings selected for the Pulse 1 behavior (Maximum Pulse 1, Minimum Pulse 1, Pulse 1 Period, and Pulse 1 Count). The LED Pulse2 Response Graph reflects settings selected for Pulse 2 behavior.

Controls in the LED Direct Rates section affect the LED Direct Ramp Rates Register (94h) and LED Off Delay Register (95h).

The LED Direct Rate Response Graph reflects the settings in the LED Direct Rates section.

7 GUI Sensor History Tab

The Sensor History tab displays a graph of sensor delta counts and allows the data to be saved to a file. Figure 7.1 shows the default view for the CAP1xxx evaluation board.
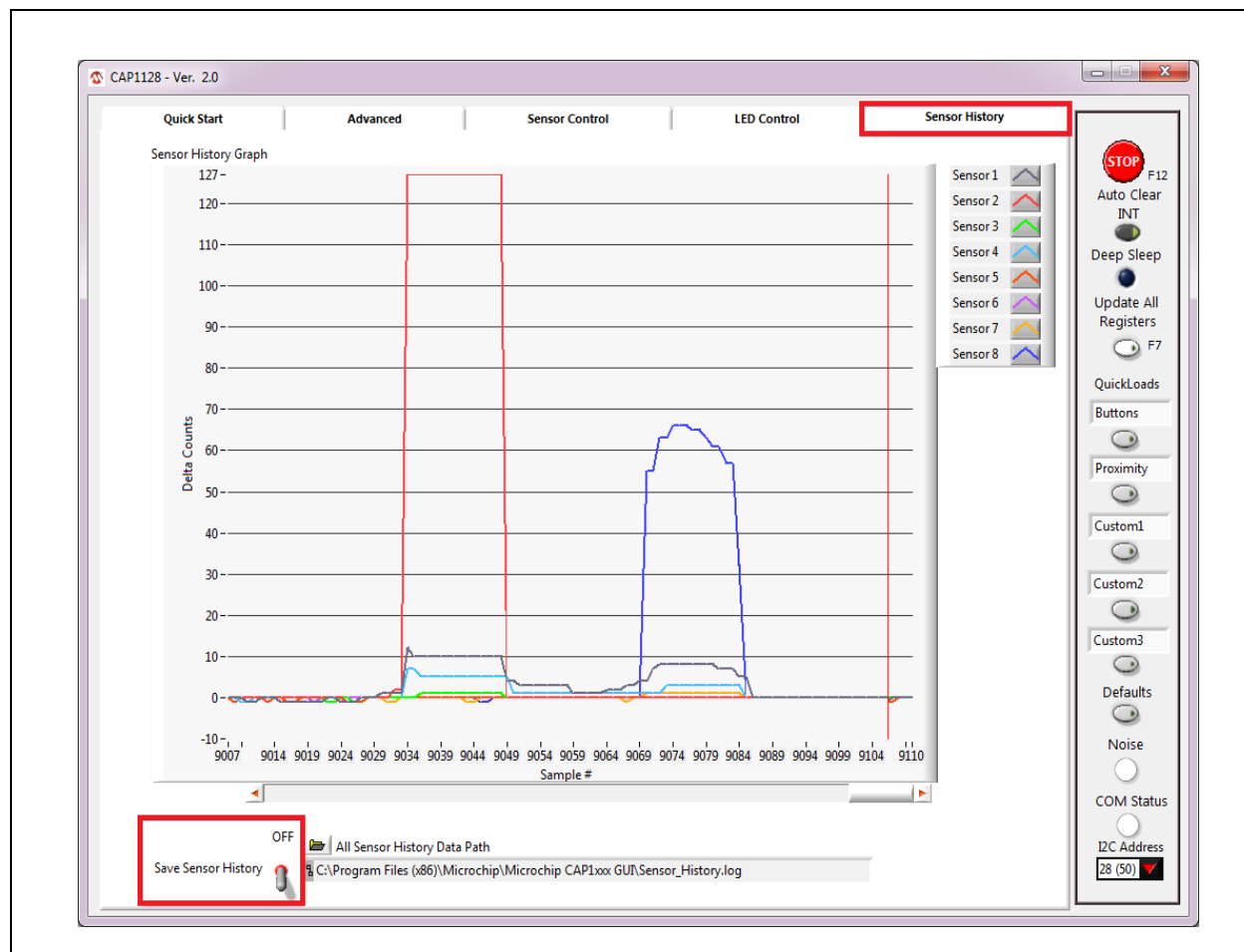
Figure 7.1 Sensor History Tab for the CAP1xxx Evaluation Board

As sensors are touched, delta counts display on the graph..

To save the delta counts over a period of time, ensure the desired path and filename are showing in the 'All Sensor History Data Path' box. To change this: Manually type in a path, or select the folder icon to browse to the desired folder and file. The file should be named with the extension ".csv". Once a file name has been chosen, click the "Save Sensor History" switch so it's in the up (Saving) position. The software will start logging data into the selected file.

Note 7.1 If a file with the same name already exists, the file will be overwritten and old data will be lost.

After generating data for a desired period of time, click the 'Save Sensor History' switch so it's in the down (OFF) position (see Figure 7.1).

The data is saved in a .csv format, as shown in Figure 7.2.

	A	B	C	D	E	F	G	H	I	J
1	Start Time	10/7/2009	2:52:21 PM							
2	Time Stamp	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7	Sensor 8	
18	14:52:22:369	1	0	0	1	0	0	0	0	
19	14:52:22:447	2	0	0	2	19	1	0	0	
20	14:52:22:541	36	2	3	2	127	1	0	0	
21	14:52:22:619	49	18	127	8	127	3	0	0	
22	14:52:22:713	127	100	127	9	104	5	0	0	
23	14:52:22:791	127	127	67	38	5	3	0	0	
24	14:52:22:869	127	106	13	5	0	0	0	0	
25	14:52:22:963	93	38	14	1	1	1	0	0	
26	14:52:23: 41	51	3	127	6	127	10	0	0	
27	14:52:23:135	56	7	127	7	127	1	0	0	
28	14:52:23:213	127	44	127	88	42	1	0	0	
29	14:52:23:291	127	30	115	127	3	1	0	0	
30	14:52:23:385	127	8	7	0	0	0	0	0	
31	14:52:23:463	19	18	16	102	1	0	0	0	
32	14:52:23:557	43	36	5	17	0	0	0	0	
33	14:52:23:635	11	5	4	1	1	0	0	0	
34	14:52:23:729	5	1	3	0	0	0	0	0	

Figure 7.2 Sample Sensor_History.csv File

8 Troubleshooting

8.1 GUI Controls Unresponsive After Installation

Restart the computer. In some cases, a restart is required after installation.

8.2 Restore Defaults

To restore defaults, press the F6 key on the keyboard or click the Defaults button (see Section 4.5.6, "Defaults Button"). Alternatively, unplug the USB mini connector from the CAP1xxx evaluation board, then plug it in again.

8.3 Control Panels Freeze

If the control panels freeze for unknown reasons, communications cannot be stopped, and the program cannot be closed, disconnect the USB cable from the CAP1xxx evaluation board, then close the program. Reconnect the evaluation board, then restart the CAP1xxx GUI.

8.4 Values in GUI Control Panels Don't Match Registers

It's possible that the GUI control panels can get out of sync with the actual register values when disconnecting and reconnecting the CAP1xxx evaluation board. If this occurs, click the Update All Registers button (see Section 4.5.4, "Update All Registers").

8.5 Communications Fail

If the device fails to communicate through the I2C bus, ensure the correct I2C address is displayed on the Communications Status and Control Panel. The CAP11xx evaluation board has a 0 ohm resistor connected between VDD and the ADDR_COM pin, and the CAP12xx devices have a static address that can only be changed at the Microchip Test Facility. So the I2C address should be 28 (50) (0101_000r/w). If an external board has been connected to the evaluation board's 8-pin communications header, a new address may need to be selected. If communications were stopped when the evaluation board was disconnected, click the Run button (see Section 4.5.1, "Stop and Run Buttons").

9 Revision History

Table 9.1 Revision History

REVISION LEVEL & DATE	SECTION/FIGURE/ENTRY	CORRECTION
CAP1xxx Evaluation Board User's Guide, Revision A replaces the previous SMSC document RightTouch CAP1188 Family EVB User Manual, Revision 1.0		

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