PenMount P2 PCIUtility
Users' Guide
For Microsoft Windows

Version 1.11

2022/02/10

PenMount
TOUCH SCREEN SOLUTIONS

Preface

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Revision Table

Date	Revision	Changes
31/May/2016	1.0	First release version.
03/Jun/2016	1.0A	Revised 0 Supported Devices
28/Oct/2016	1.1	(1) Added 0 Special Notice (2) Added 4.5.1 Palm Rejection Switch (3) Added 4.9.2 Edge Compensation (4) Added 0 Touch and Halt
16/Nov/2016	1.1A	Revised: 4.5.4 Disabled range near palm Revised: 4.10.2 Idle mode settings
25/Apr/2017	1.2	(1) PM1415, PM1715, and PM2204 are added to the supported device list. (2) Update for PCIUtility V1.2.x (3) Add: Section 2.4 for Environmental Reference (4) 3.9.1 Calibration, the hotkey for skipping calibration checkpoint is changed to F9.
29/Aug/2017	1.3	(1) 1.2 Support Device, PM2251 are added to the supported device list. (2) Removed 1.4.2 Application Version and 1.4.3 Open Default Export File Folder (3) 2.1 Open Short Test, added "Near Check" and "Flat Check" (4) 2.4 System Reference (SR), modified "Environmental Reference" to "System Reference". (5) 3.1 Main Features, modified "Import Parameters" to "Import PCIUtility UI Parameters," "Export Parameters" to "Export PCIUtility UI Parameters," "Reload Default Parameters" to "Reload Factory Default Parameters". (6) Removed "Baud Rate Setting"

		(7) 3.8.2 Enhanced Driving, added new function "Enhance Driving Switch".
		(8) 4.1 Load Firmware File, added "pfp format" support.
		(9) 6.5 Log Noise Information, added "Log Noise Information".
03/Jan/2018	1.4	(1) Added "Parameters CRC" to page display items
		(2) Added 1.5: Log UI Parameters Information Button under Information item, can read/write UI Parameter.
		(3) Added Auto Save Log Button to 2.1.3 Open Short Test function.
		(4) Added 2.4.3 Options, "Switch on the System Reference Dialog Box" and "Auto Save Log Button" selections to System Reference function.
		(5) Changed 3.1 Export / Import Parameters file format from PMP to INI format in the Parameters item.
		(6) 3.9.3 Orientation, corrected Orientation display method.
		(7) Added "Writer Factory Default Parameter" and "Write Host Interface/Panel Parameters" selections under 5.2 Firmware Update item.
20/Jul/2018	1.5	(1) 5.1: add description of utility supporting pfp files with virtual button settings.
		(2) 5.2: add description of utility automatically selects write factory default option when using PMF or PMC file.
31/Jan/2019	1.6	(1) 1.4: New options in the "Information" page.
		(2) 1.7: New command line options.
		(3) 2.4.3: New "Select Folder" option in "SR" page.
		(4) 4.8: New "Anti-noise" parameters.
		(5) 3.9.1: New Resolution Setting.
		(6) 5.1: New "pnc", "pnf", "pxc", and "pxf" format supported.

		(7)	5.3: New button to generate PFP file in the "Update" page.
		(8)	7.2: Remove "Log Noise Info" and combine the function into "Log Current Device Information".
		(9)	8: New "Process Config" feature
30/Sep/2019	1.7	(1)	4.2.5: The Hid Report Parameters.
		(2)	The customize panel settings.
		(3)	4.13: The customer specific parameters.
		(4)	New section for generating golden samples.
		(5)	: Descriptions of the new "Diagnostic Test" option.
20/May/2020	1.8	(1)	Removed: Custom Panel Setting, Process List Golden Sample and Diagnostic Test.
		(2)	Add: 1.4.3 DLL Version.
		(3)	Add:1.4.4 Core Version.
		(4)	Add: 1.4.6Folder Configure.
		(5)	Add: 2.4.3 Reset SR.
		(6)	Modify: 4.2.5 Renamed to Digitizer and Mouse Mode, also show corresponding USB Product ID.
		(7)	Add: Edge Adjustment.
		(8)	Modify: 4.8.1 Median Filter Renamed to Spike Filter.
		(9)	Modify:4.8.3 Enhanced Frequency Hopping Renamed to Frequency Hopping Mode.
		(10)	5.1: Show CRC information of ND Base.
		(11)	Add: 8.3 Skip Noise Level N Times Setting.
31/Mar/2021	1.9	(1)	Document Title Changes to PenMount P2 PCIUtility Users Guide.
		(2)	Modify: 1.7 psave and pload command line options.
		(3)	Modify: 2.1 Open Short Test Renamed to Panel Quality Test.

		(4)	Add: 4.8.3.2 Double ADC, FH Plus, and FH Tuning options.
		(5)	Modify: 4.9.4 Thick Front Bezel Switch
09/Apr/2021	1.9A	(1)	Modify: 1.7 -srns and -fu command line options.
30/Apr/2021	1.9B	(1)	Modify: 2.4, add notes that SR is required when using WD or WP.
		(2)	Modify: 4.7.1, add notes that SR is required when using WD or WP.
31/May/2021	1.10	(1)	Modify: 1.4.5, ND Base CRC information.
		(2)	Modify: 2.4.2, Add options for changing background color.
		(3)	Add: Chapter 3, Quick Select of touch modes.
		(4)	Modify: 4.8.3.2, the finetuning UI and parameters.
		(5)	Modify: 4.8.3.3, introducing new UI.
12/Oct/2021	1.10A	(6)	Modify: 5.3, include notes for PFP file creation.
10/Feb/2022	1.11	(1)	Modify: 1.3, update file summary.
		(2)	Modify: 2.1 Panel Quality check AFF option.
		(3)	Add: 4.2.3 I2C over HID protocol switch.
		(4)	Add: 6.3, Event Log utility.
		(5)	Add: 6.4, Panel Config utility.

Table of Content

1. Introduction

This document provides information for using PenMount PCIUtility to determine touch device settings and perform updates and tests.

1.1 Supported Systems

PenMount PCIUtility can operate in the operating systems listed below:

Types	Operating Systems
Desktop	Windows XP (32/64bit)
	Windows Vista (32/64bit)
	Windows 7 (x86 32/64bit)
	Windows 8 / 8.1 (x86 32/64bit)
	Windows 10 (x86/AMD64/ARM64)[1]
	Windows 11 (AMD64/ARM64)
Server	Windows Server 2003 / R2
	Windows Server 2008 / R2
	Windows Server 2012 / R2
	Windows Server 2016 / 2019
Embedded	Windows XP Embedded / Standard 2009
	Windows Embedded Standard / POSReady 7
	Windows Embedded 8 Standard / Industry
	Windows 10 IoT Enterprise

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[1] Recommend using the Windows 10 Anniversary Edition 1607 (10.0.0.14393) and later versions.

1.2 Supported Devices

Devices and interfaces supported by PenMount PCIUtility are as follows:

Series	Control Board	USB	RS-232 / UART	I²C [2]
PenMount P2-02 Series	PM1100		v	
	PM2101		v	v
PenMount P2-03 Series	PM1200	v	v	
	PM1201A	v	v	
	PM2201	v	v	v
PenMount P2-04 Series	PM1300A	v		
	PM1302	v	v	v
	PM1302B			v
	PM1400A	v	v	
	PM1401	v	v	
	PM1401A	v		v
	PM1500	v	v	v
PenMount P2-06 Series	PM1110A		v	
	PM1210	v	v	v
	PM2103	v	v	v
	PM2203	v	v	v
	PM2203B	v	v	v
	PM2203C	v		
	PM2204	v	v	v
	PM2251	v	v	v
	PM2252	v	v	v
	PM2351	v		
	PM2300	v	v	v
	PM2301A	v	v	v
PenMount P2-08 Series	PM1310	v	v	v
	PM1410	v	v	v
	PM1415	v		v

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[2] The I²C, UART / RS-232 interface is supported by connecting though the PMT101 Adapter.

	PM1710	v	v	
	PM1711	v		v
	PM1715	v		v
	PM2205	v	v	v
	PM2206	v		
	PM2303	v	v	v
	PM2304	v	v	v
	PM2356	v	v	
	PM2357	v		
	PM2358	v	v	v

1.3   File Summary

The application and library files in the package are summarized as below.

Utility	Usage	Application Version	Notes
PCIUtility.exe	Advanced firmware configuration	1.11.X	x86 32-bit Windows application.
PM_Standard.dll	Companion library of PCIUtility.	1.6.X	
PCIUtility.ini	Default settings of PCIUtility.		
iBTEventLog.exe	The Event Logging tool.	1.17.X	x86 32-bit Windows application.
Setting.ini	Settings of iBTEventLog		
PanelConfig.exe	Panel configuration utility.	1.6.X	x86 32-bit Windows application.
PanelConfig.ini	Settings of PanelConfig		
IB_Standard.dll	Companion library of iBTEventlog and PanelConfig utility.	1.4.X	

The application version can be found on the "Information" page.

1.4   Checking Utility Information

The version of PCIUtility and other useful information are listed on the "Information" page.

FIGURE 1

1.4.1 Device Information

Connected device information consists of several parts:

- Master Firmware / Slave Firmware / Test Version

  The firmware version of the connected device.

  If marked as "Test Version", it means that this firmware is for testing purpose only.

- Parameters CRC

  A code for identifying parameter sets. Same firmware versions with different CRC values indicates there are parameter differences.

- Host Interface

  The connected interface, most P2-06 and P2-08 devices support interface auto detection.

- Panel Information

  Configuration of panel size and cover lens thickness.

1.4.2 Application Version

It is the version of the utility.

1.4.3 DLL Version

This is the version of the PM_Standard.dll file that the utility is using.

1.4.4 Core Version

It is the version of the firmware core features. Different firmware with similar core versions means that their performance result will be close too.

1.4.5 ND Base CRC

When this CRC value appears, it means that this firmware comes with some extra preconfigured noise compensation settings.
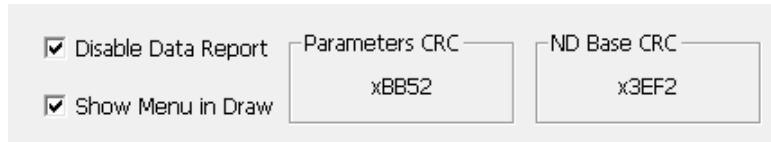
1.4.6 Open Default Export File Folder

Pressing this button will open the file manager and allow user to browse the test results, parameters, and other files generated by PCIUtility. By default, the directory is located at:
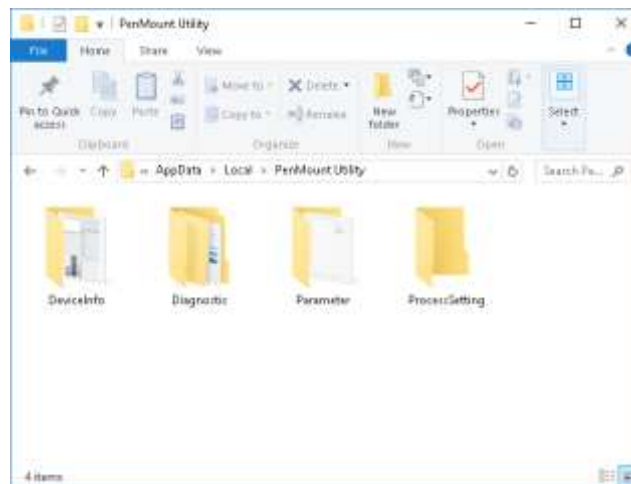
%LOCALAPPDATA%\PenMount Utility

FIGURE 3

1.4.6.1 Log UI Parameters Information

Pressing this button will save all the parameter settings in human readable format from the connected device. This feature is useful when comparing the parameter differences of two devices with different CRC values.

FIGURE 4

1.4.7 Disable Data Report

When this option is checked, touch will be disabled when PCIUtility is running.

1.4.8 Show Menu in Draw

When this option is checked, a menu button will appear in Draw mode. Please check chapter 6.2 for each

option in menu.
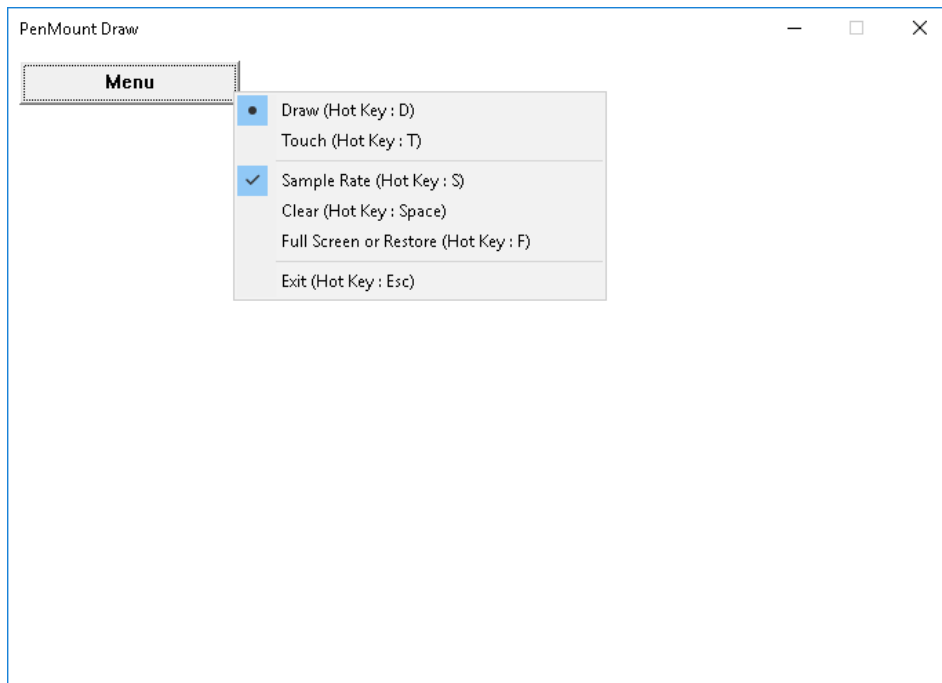
FIGURE 5

1.5 Refresh and Reset Device

If device is not connected when utility starts up, it can still automatically detect when device is attached with USB interface, or user can press the "Refresh" button for manually detecting RS-232 / UART devices.

Please notice that is no device is connected, only "Refresh", and "Information" pages can be accessed. If the devices is connected, PCIUtility shows "Reset Device". The user can reset device by this button.
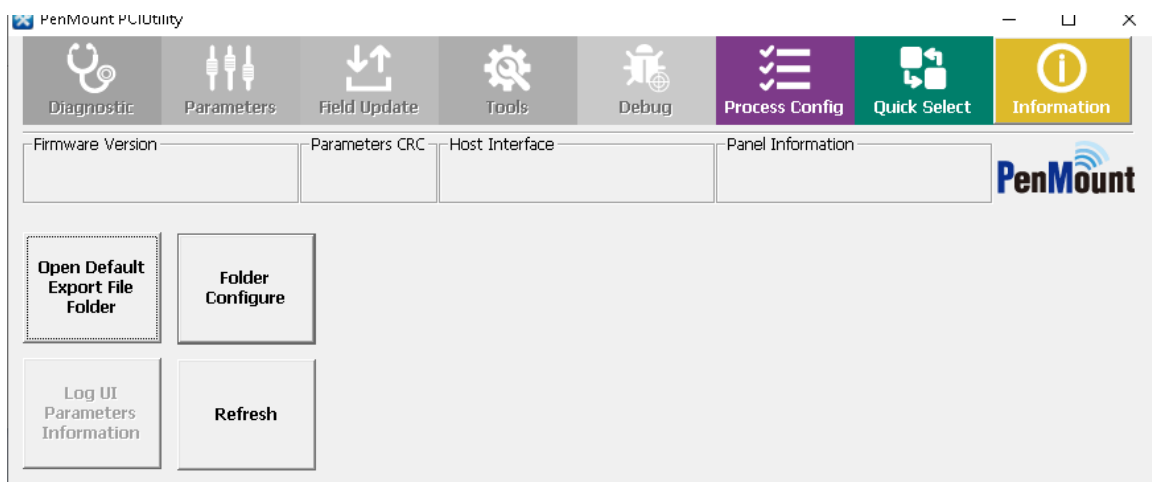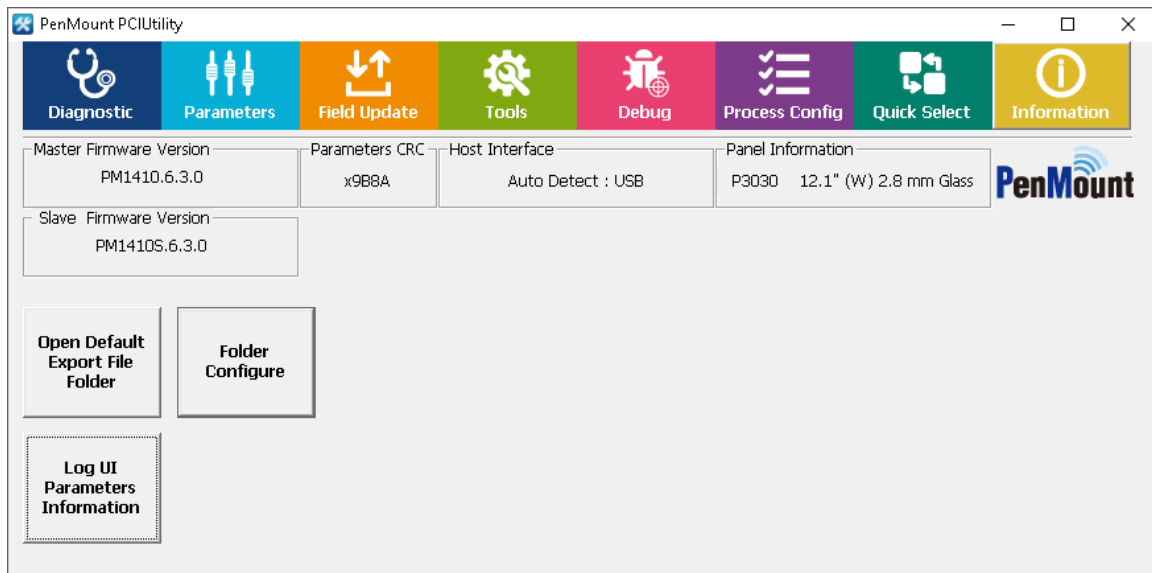
FIGURE 6

1.6 Special Notice

1. PenMount PCIUtility can only support the setting and operation of one single device at one time.

2. Not all PenMount Utilities can be opened simultaneously.

1.7 Command Line Features

This version of PCIUtility supports the following command line options. Please choose one of the following options.

Option	Description	Feature Reference
-os	Panel Quality (Open Short) Test	Section 2.1
-nl0	Noise Level Test, using pattern "NONE"	Section 2.2
-nl1	Noise Level Test, using pattern "WHITE"	
-nl2	Noise Level Test, using pattern "BLACK"	
-nl3	Noise Level Test, using pattern "CHECKERBOARD"	
-sr	Build System Reference	Section 2.4
-srns	Build System Reference (no dialog box for log saving)	Section 2.4
-psave	Saves parameters of the connected device to INI file.	Section 3
-pload	Loads parameters from specified INI file to connected device	Section 3
-fu	Load specified firmware file and perform firmware update.	Section 5

2. Diagnostic

PCIUtility provides standard product testing procedures, including:

● Panel Quality Test: test the electrical functions, including open-short tests of PCI touch panels.

● Noise Level: detect the size and area of the PCI touchscreen influenced by noise interference.

● 3D Module: graphical view for diagnosing raw signal.

● System Reference: allow user to rebuild the reference data used for adjusting environmental changes. This feature is only supported in some device firmware versions.

FIGURE 7

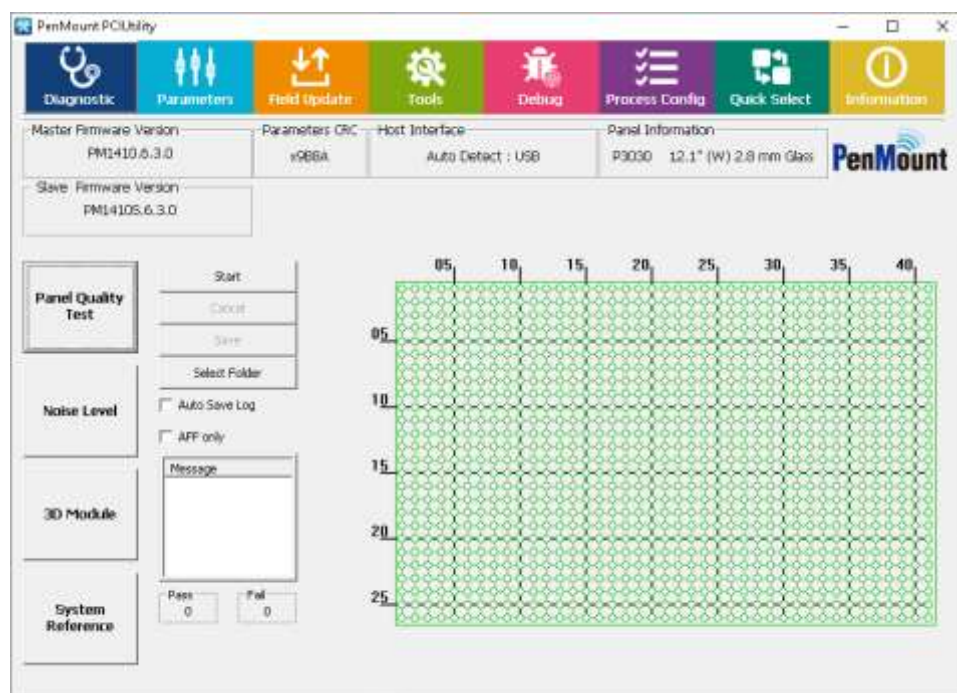## 2.1 Panel Quality Test

The panel quality tests sensor and driver pins for possible open / short issues. To ensure the accuracy, please do not perform any touch action while the test is running.

Click the "Start" button; this will start electrical detection on the touchscreen.   When a single test is running, status will display "START" and "progress" will rise from bottom to top.

FIGURE 8

Once detection is completed, the result will appear as the status. If the touchscreen is normal, PASS will be displayed. If it is abnormal, FAIL will be displayed. To the right side of the Status field is the "Pass & Fail" field, indicating the number of Passes or Fails after the program starts to run detection.
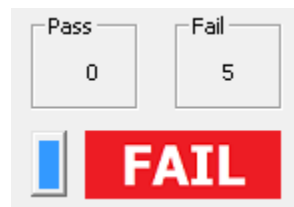

FIGURE 9

Meanwhile, the status of the touchscreen is shown at the right side of the window. Green means the node is normal and red means abnormal.
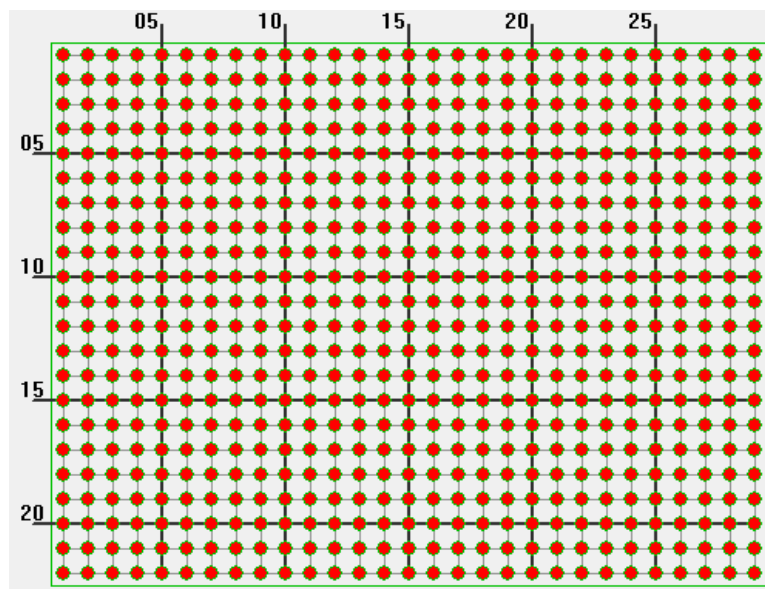
FIGURE 10

2.1.1 Test Items

When diagnosis starts, the program measures raw data from every node on touch panel. Three sets of raw data are collected for signal testing. The primary test items are as follows:

Items	Explanation
Debounce Check	If the three sets of raw data on all the nodes of the touch panels are distinctively different from one another and larger than Debounce threshold, it is determined as abnormal.

Driver Pins Abnormal Check	Test the raw data of two consecutive driving pins (use the signals for the third test) and the difference between them should not be excessively large. If the raw data of over one third of the nodes of the two neighboring driving pins is over Driver Abnormal threshold, the driving pin with higher raw data will be marked "abnormal".
Sensor Pins Abnormal Check	Test the raw data of two consecutive sensor pins (use the signals for the third test) and the differences should not excessive. If the raw data of over one third of the nodes of the two neighboring sensor pins is larger than Sensor Abnormal threshold, the sensor pin with higher raw data will be determined as a short circuit and marked "abnormal".
Same Raw Data Check	If the three sets of raw data on all the nodes of the touch panels are identical, it is determined as abnormal.
Illegal Data Check	Checks whether raw data is negative.
Absolute Data Check	Checks whether raw data is within valid range.
Near Check	Checks whether the raw data of two adjacent driver lines/sensor lines is similar.
Flat Check	Checks whether the base is flat.

2.1.2 Test Result & Analysis

When diagnose ends, the program displays messages for each failed test items:
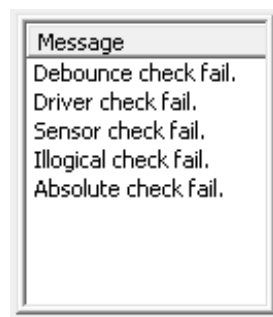
FIGURE 11

The table below lists possible messages.

Message	Description
PASS	All test item passed
Check Debounce fail	Debounce Check failed
Check Base Flat fail	The Base Signal Regularity Check failed.
Driver check fail	Driver Pins Abnormal Check failed

Sensor check fail	Sensor Pins Abnormal Check failed
Same check fail	Same Raw Data Check failed
Illogical check fail	Illegal Data Check failed
Absolute check fail	Absolute Data Check failed
Near check fail	Near line raw data check failed
Flat check fail	Base flat check failed

After the test is completed, nodes with abnormal signals will be immediately indicated. They are usually classified in three types:

1. Single point abnormal

    When the test result is "single point abnormal," it is because the difference of the signal values for one location and the ambient nodes is too large. If the grounding for the system is not ideal, which may lead to touch instability, abnormality will be tested at different nodes during each test.
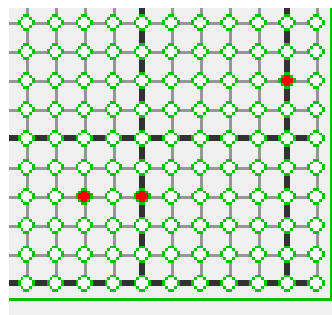

FIGURE 12

2. Whole pin abnormal

    When the test result is "Whole pin abnormal," it is usually either due to the open state of sensor/driving pin or too many abnormal nodes on the same pin.
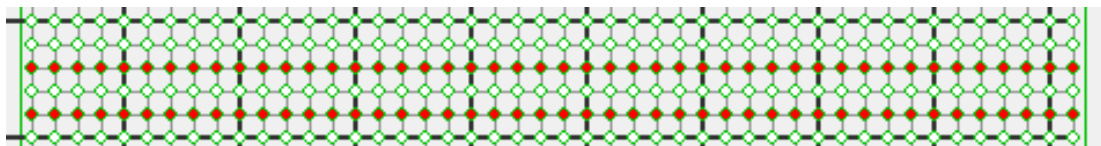

FIGURE 13

3. Whole panel abnormal

When the test result shows whole panel abnormal, it is usually because the signals detected never change during the process. When you are connecting the touch panel with the control board, if the cables are not connected properly, this will happen.

In some circumstances, it is hard to see where the problem is from the appearance of the product. You can run PCIScan and cross reference to determine whether the source of the problem is the control board or the touch panel.

2.1.3   Save Test Results

If the touch panel shows "signal abnormal," you can save the results into a file and provide it to PenMount for further analysis. You can click "Save" after the test is completed. The "Select Folder" button allows changing of the target folder for saving test results.
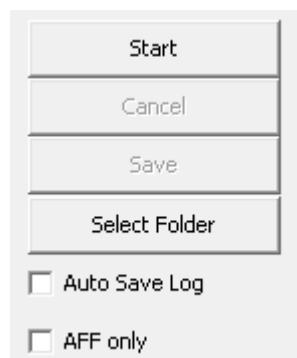
FIGURE 14

A dialogue box below will appear. The user must enter "Batch Number 1" and click OK to save. We suggest using the touch panel number as the "Batch Number" for future identification. The program will save the test results either in the "TestPass" or "TestFail" folder based on the test results under $ProductNumber_$BatchNumber_$Month$Day$Hour$Minute$Second".csv.

● Auto Save Log

With this option checked, the "Save File" dialog will automatically appear.

● AFF only

Select this option if the target panel is AFF type. It will skip the "base flat" checking, which could fail when testing AFF type of touch panels.

2.1.4   Test Log

The program will save the detected signal in CSV file. The format of CSV is a text file, which can be opened with spreadsheet software such as Microsoft Excel.;

• Basic data

The beginning of the CSV file records data for the corresponding touch panel and controller. You can also see the threshold value for the test.

FIGURE 15

- RawData

The CSV contains several sets of raw data which are the basis for judgment for each test.

[RawData]							
0	1	2	3	4	5	6	7
1	493	498	499	503	501	503	509
2	511	526	525	528	527	528	528
3	514	528	528	530	531	533	533
4	508	519	523	525	526	528	529
5	501	509	510	512	519	519	519
6	516	528	534	534	531	533	533
7	517	528	528	531	532	532	539
8	512	519	523	524	521	527	526
9	518	525	527	528	530	530	533
10	520	529	529	527	530	531	538
11	519	531	535	537	535	533	538
12	514	528	525	529	529	529	534
13	516	524	527	527	530	532	539
14	525	536	537	537	538	540	553
15	534	535	540	538	542	541	558
16	523	537	534	534	534	534	536
17	528	534	536	538	540	538	545
18	530	538	540	539	541	541	546

FIGURE 16

Raw data is arranged in a two-dimensional array, which corresponds to the nodes on the sensor and the driver pin. The nodes with * are abnormal. From the raw data, you can presume the reason for the abnormality. In the example below, there is obviously less raw data coming from the nodes marked abnormal than the surrounding nodes.
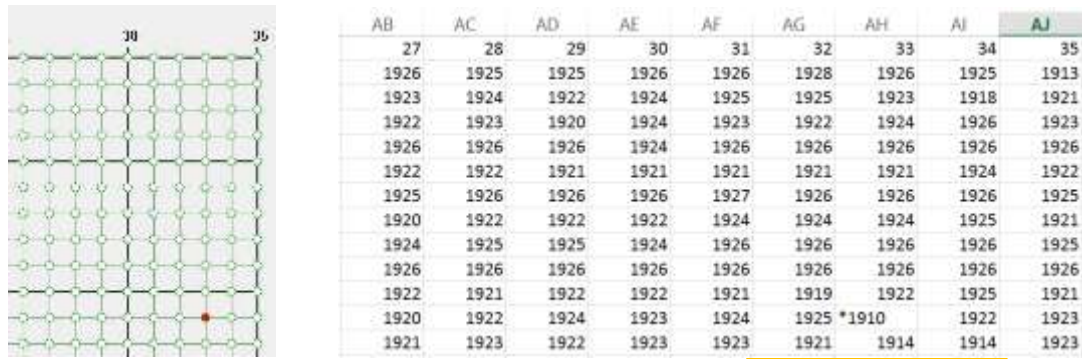
AB	AC	AD	AE	AF	AG	AH	AI	AJ
27	28	29	30	31	32	33	34	35
1926	1925	1925	1926	1926	1928	1926	1925	1913
1923	1924	1922	1924	1925	1925	1923	1918	1921
1922	1923	1920	1924	1923	1922	1924	1926	1923
1926	1926	1926	1924	1926	1926	1926	1926	1926
1922	1922	1921	1921	1921	1921	1921	1924	1922
1925	1926	1926	1926	1927	1926	1926	1926	1925
1920	1922	1922	1922	1924	1924	1924	1925	1921
1924	1925	1925	1924	1926	1926	1926	1926	1925
1926	1926	1926	1926	1926	1926	1926	1926	1926
1922	1921	1922	1922	1921	1919	1922	1925	1921
1920	1922	1924	1923	1924	1925	*1910	1922	1923
1921	1923	1922	1923	1923	1921	1914	1914	1923

Figure 17

- PDData

  This is the raw data used during the "Illegal Data Check".

- SectData

  This is the sector scan result. For reference only.

- SelfData

  This is the abnormal scan result. For reference only.

- Raw Data Near

  This is to check total delta of adjacent sensor and driver.

- Base Flat

  This checks whether base is sufficiently flat.

2.2　Noise Level

The Noise Test mainly evaluates the degree of noise interference impact on the touch panel. Usually, noise will affect measurement and large fluctuations will be produced. The program will display the "noise level" interface:
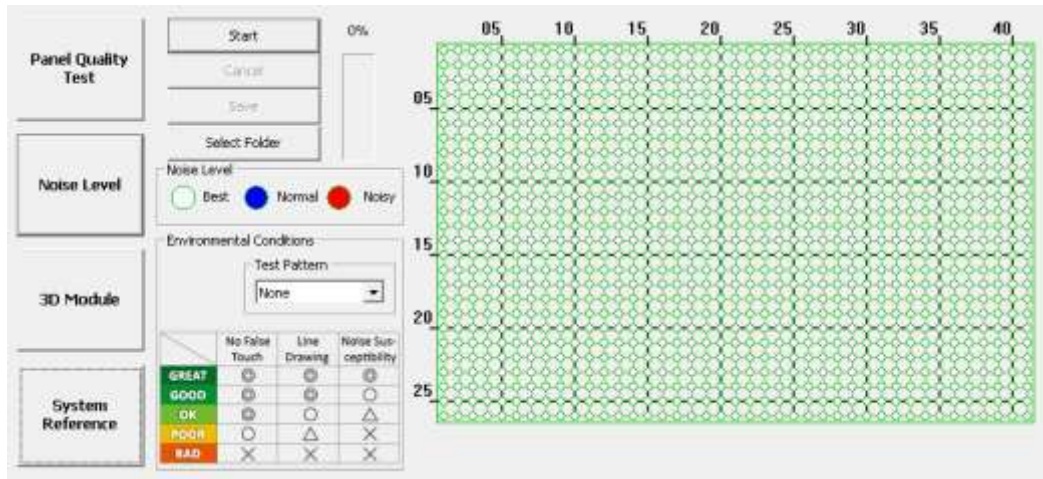
FIGURE 18

2.2.1   Execute test

Please click "Start" on the left side of the window to start running the test. To ensure test accuracy, please avoid any touch input during the test.

During this period of time, progress will be displayed in the window caption. All other utility features will be temporarily disabled during the test. Usually, the test takes longer when using larger panel sizes. Please click "Cancel" if want to abort to sue other features.
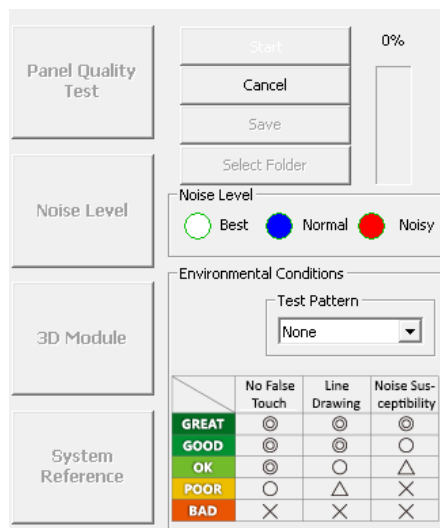

FIGURE 19

For testing LCD noise interference with specific display patterns, please change "Test Pattern". Currently "White", "Black", and "Checkerboard" are supported. Please be aware that after pressing the "Start" button, the LCD will display the specified pattern in full screen mode until the test finishes.
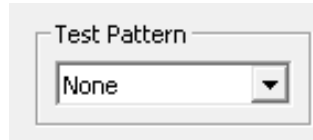
27

2.2.2   Test Analysis

According to the standard deviation calculated from the raw data, the program will be categorized nodes on the touch panel as "Best", "Normal," and "Noisy" and mark them respectively in white, blue, and red.
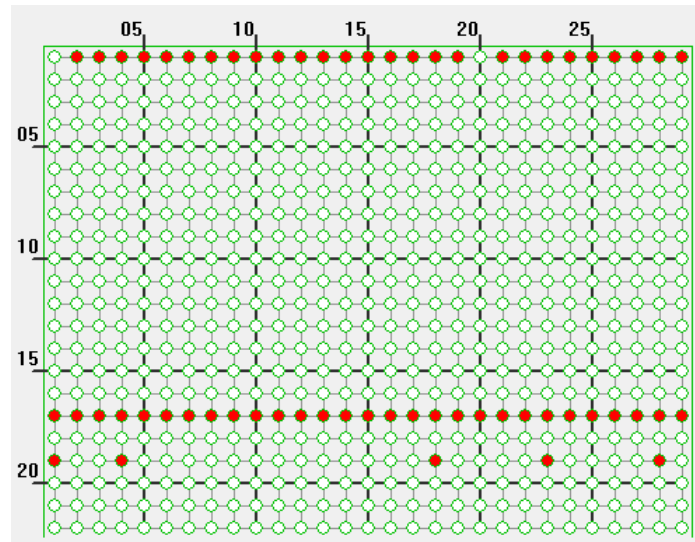
The right side of the program indicates the degree of signal changes in the nodes on the touch panel.
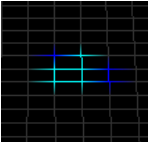
Nodes marked with a red circle indicate a greater change in the signal value measured and it may be unstable.

To give the user a better idea of overall signal changes, the program will analyze and show the environmental criteria, and classified in 5 levels: "GREAT", "GOOD", "OK", "POOR", and "BAD".

FIGURE 22

Generally speaking, please try to lower noise interference by increasing the air gap between touch panel and LCD, bring environmental conditions to a least "OK" level.

2.3   3D Module of Touch Signal

Pressing the "3D Module" button launches the 3D module for inspecting touch or noise signals. Please prepare a mouse or keyboard before launching this feature, because touch will be disabled during the entire process.

FIGURE 23

The program will use different colors to show the signal strength.

Colors	Signals

Colors	Actions
Cyan	Larger positive signals, possibly identified as finger touch
Blue	Smaller positive signals, usually caused by environmental noise
White	Normal signal and No touch
Magenta	Smaller negative signals, usually caused by environmental noise
Red	Larger negative signals, possibly caused by water, etc.

The 3D module supports several hot keys listed in the table below.

Colors	Actions
top	5 degree X axis counterclockwise rotation
down	5 degree X axis clockwise rotation
left	5 degree Y axis counterclockwise rotation
right	5 degree Y axis clockwise rotation
+	Zoom in
-	Zoom out
O	Restore to default angle: 225 degree X axis counterclockwise rotation, 270 degree Z axis clockwise rotation
B	Reinitialize the base signal
C	Change displayed mode.
	Mode

	Mode 1	
	Mode 2	

2.4 System Reference (SR)

The "System Reference" is supported in most P2-06 and P2-08 device firmware, which is essential when using firmware water handling features (WD / WP). Without SR built, environmental changes could cause unexpected behaviors.

If the "System Reference" button is greyed out, it means that the device firmware does not support system reference.
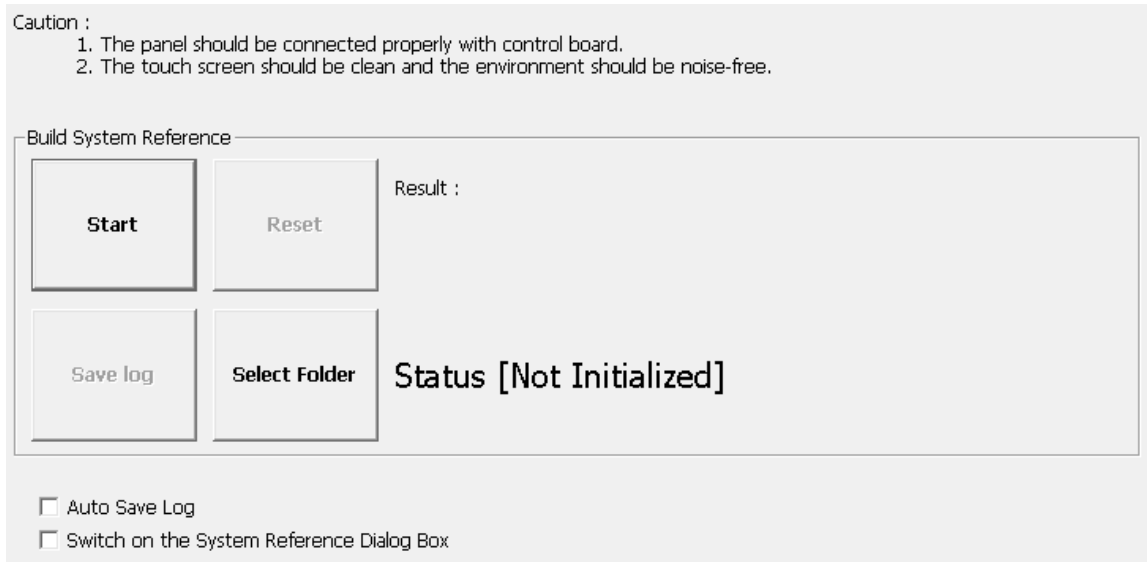

FIGURE 24

2.4.1 Checking Status

The utility shows the status on screen, and can be one of the following:

Status	Description
Active	The system reference is built and in use
Not Initialized	The device does not have a valid system reference. Please press start to rebuild it.

In the following cases, the utility will check the reference status and prompt rebuild a new set of reference data.

- A new touch controller is connected.

- Firmware update is performed.

- The setting of touch panel size or cover lens thickness has changed.

32

2.4.2　Rebuild the System Reference

Before proceeding to rebuilding the system reference, please check the following:

1. The touch panel is connected to control board properly.

2. The touch screen surface is clean, and free of objects such as water, hands, fingers, etc…

3. The build environment is noise free (check using 3D module).

4. Check the LCD type, and specify a proper background color in PCIUtility.ini file, qhich will be used during construction.

```
[Build System Reference]

Background=0
```

Background	Displayed Mode
0	White background
1	Black background

The rebuild process should take a few seconds after pressing the "Start" button, please wait until the progress bar proceeds to 100%.

Work in progress. Please wait....1%
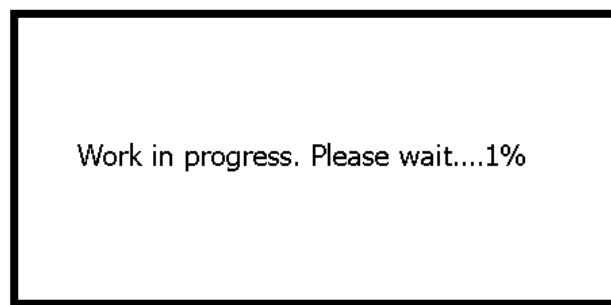
FIGURE 25

If the touch panel is not con ... the utility will display a warning message after build completes. User must confirm whether to accept the build result by pressing the Yes or No button.
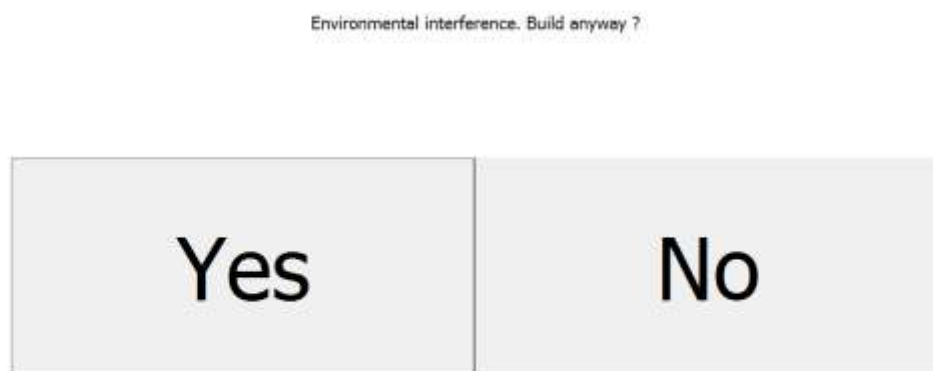
33

Environmental interference. Build anyway ?

Yes	No

FIGURE 26

Utility will display a "FAIL" message if user presses the "No" button, and utility will roll back to previous settings.

2.4.3   Options

There are several options that user can adjust:

- Reset

Select this will reset the System Reference in device to an initialized state.

- Select Folder

Select the destination folder that log file will be saved to.

- Save Log

This option is available only after SR is built. It will save the SR status to the specified directory.

- Auto Save Log

With this option checked, the "Save File" dialog will automatically appear after the SR construction operation finishes.

- Switch on the System Reference Dialog Box

When this option is checked, the PCIUtility will notify user for SR construction when it detects that SR is not initialized.

System reference build

PM1415.6.1.0   should be work normally with system reference, which has not built in this control board. Would you like to build system reference now?

Yes   No
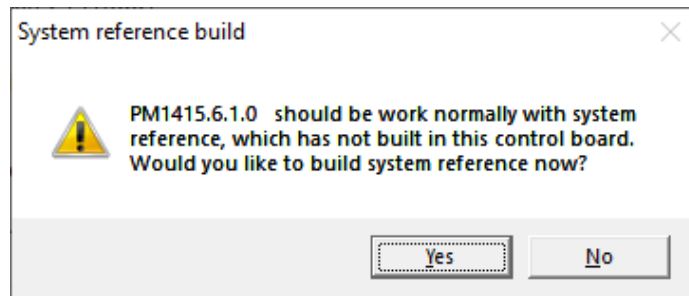
FIGURE 27

3. Quick Select

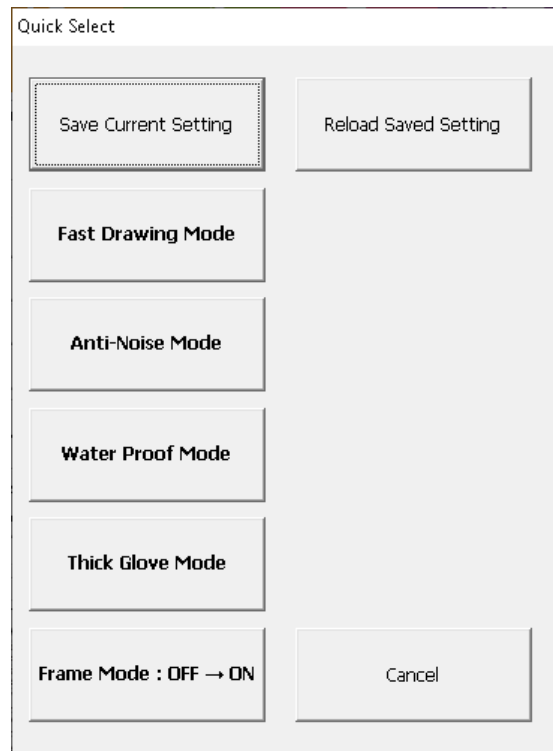This panel includes convenient way for switch between different operation modes.

FIGURE 28

The "Save Current Setting" and "Reload Saved Setting" are basically the same as the "Import Parameters" and "Export Parameters" feature in the Parameters Panel.

The supports modes are listed below:

Mode	Feature	Side Effect
Fast Drawing Mode	Allow smooth drawing	Environmental noise will have greater impact.
Anti-Noise Mode	Maintain normal touch operation in environments with high noise.	Lesser sampling rate.
Water Proof Mode	Prevents abnormal touches caused by water.	Lesser sampling rate.
Thick Glove Mode	Allow touch operation with thick gloves	Environmental noise will have greater impact.

The following chart compares the major parameter differences between each mode when using device firmware V6.3 or later versions.

Modes		Standard	Fast Drawing	Anti-Noise	Water Proof	Thick Glove
Sensitivity		0	0	0	0	+3
Water Handling		OFF	OFF	OFF	Water Performance	OFF
Palm Rejection		ON	OFF	ON	ON	OFF
Anti-Noise	Spike Filter	Normal	Lite	Enhanced	Normal	Normal
	Enhanced Driving	OFF	OFF	ON	OFF	ON
	Double ADC Average	OFF	OFF	ON	OFF	OFF
	Frequency Hopping	Normal	Lite	Enhanced	Normal	Normal
Max Contact Number		Default	Default	Default	1	Default

3.1 Frame Mode

When touch panels are mounted on LCD with thicker frame design, it would not be easy for a finger to touch the UI elements near the edge.

For firmware V6.3 and later, switch to frame mode enables the "Thick Frame Bezel" parameter.

Modify Parameter List ✕

Thick Front Bezel Modify : (ON)

OK   Cancel
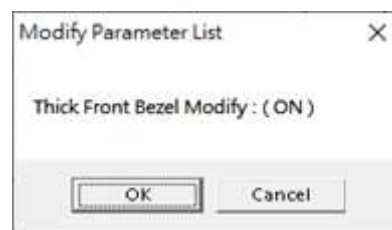
FIGURE 29

For firmware V6.2 or earlier, switch to frame mode adjust the sensor / driver lines used by device firmware to work with thicker frames.

Modify Parameter List ✕

Panel Skip Sensor Modify : 1 -> 2
Panel Skip Driver Modify : 2 -> 3
Panel Used Sensor Modify : 9 -> 7
Panel Used Driver Modify : 12 -> 10

OK   Cancel
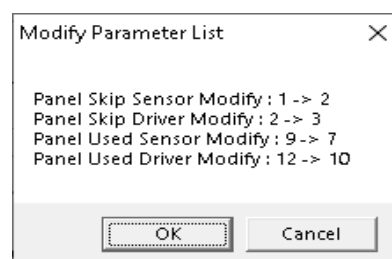
FIGURE 30

The definitions of Skip Sensor, Skip Driver, Used Sensor, and Used Driver are defined as below.

4. Parameters

Parameters provide an interface to flexibly fine tune PenMount firmware settings.

FIGURE 31

- The "Apply" Button

  Applied all the parameter changes. Any unapplied change will be lost when closing the utility.

- The "Export Parameters" Button

  Export the firmware parameter values into a text file with ".ini" extension.

- The "Import Parameters" Button

  Import the firmware parameter values from a text file with ".ini" extension. Only parameter files for the same firmware version can be imported.

- The "Write Factory Default Parameters" Button

  Reload the firmware parameters to factory default. However, the parameter of host interface and panel size will not be changed.
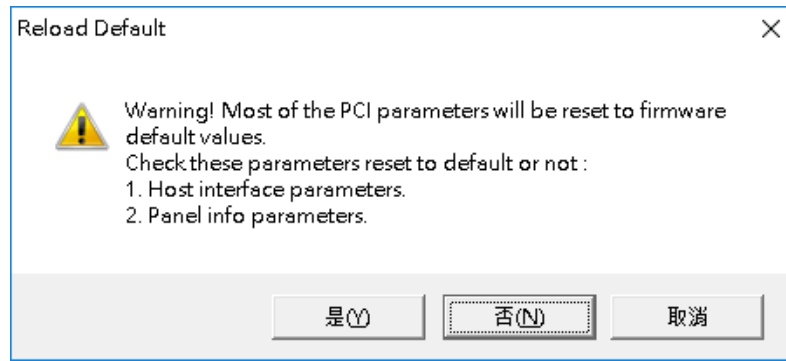
FIGURE 32

4.1 Main Features

The Parameters configuration interface includes the following features.

1.   The Parameters Panel

Parameters are categorized into different tabs. For example, parameters related to anti-noise layout can be found in the "Ant-Noise" tab. When adjusting a parameter, its features and side effects will aooear for quick reference.
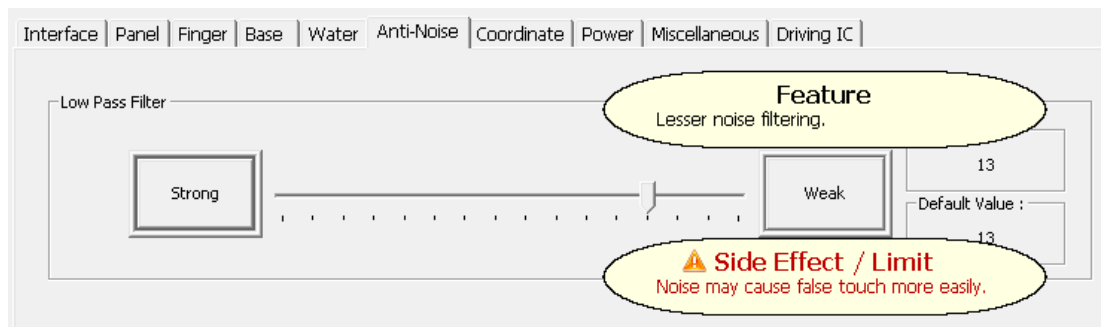
FIGURE 33

- Grayed out Options.

Any parameter in gray is not adjustable. In the following example, "Change Interface" is not adjustable, because the firmware supports interface auto detection, so there is no need to manually assign the connection interface.
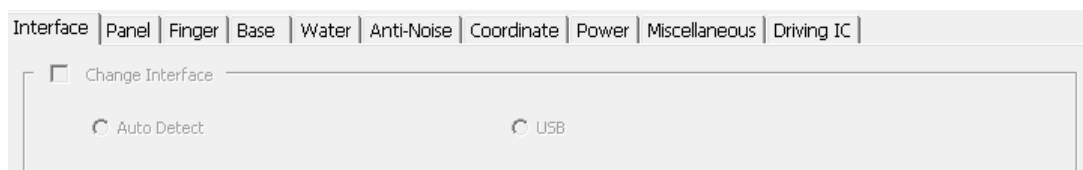
FIGURE 34

- Hidden Options

    Any parameter that is not displayed also means that it is not adjustable. In the following example, when using older firmware versions such as PM1410 V2.1, the utility only displays fewer tabs with a few adjustable options.
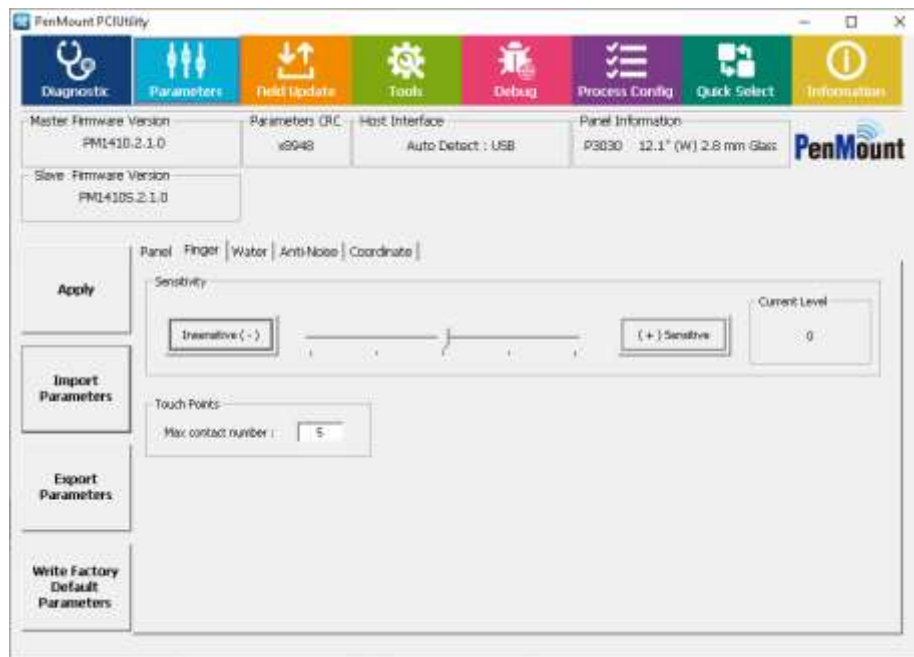
FIGURE 35

4.2 Interface Parameters

Users can change interface settings in the "Interface" tab.
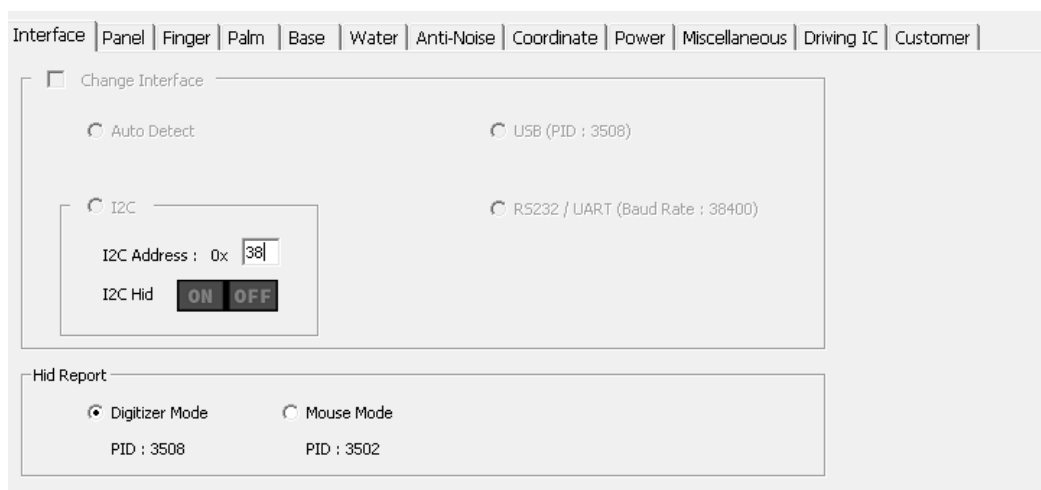
FIGURE 36

4.2.1 Change Interface

User can manually specify the connection interface when using PenMount COF products. For control boards, since the firmware can automatically detect connection interfaces, this field is not adjustable.

4.2.2   I2C Address

The slave address when using I^{2}C connection. Please change this value if the default slave address 0x38 conflicts with other devices.

Please note for P2-08 devices, this feature is adjustable only with boot loader version 6.4 and later.

4.2.3   I2C HID

The PenMount P2 firmware V6.4 and later additionally supports I2C over HID protocol. Please use this to switch between the PenMount I2C protocol and the I2C over HID protocol.

4.2.4   Baud Rate

The transfer baud rate is used for UART/RS-232 connection.

For compatibility with PenMount device drivers, meanwhile PCIUtility does not allow changing baud rate.

4.2.5   Hid Report

Some firmware versions support using different Hid Report type. If these options are disabled, it means that the connected device firmware does not support this feature.

	Digitizer Mode	Mouse Mode
USB Product ID	0x3508	0x3502
Gesture Support	YES	NO
Windows XP	NO	YES
Windows 7 / 8 / 10 / 11	YES	YES

4.3   Panel Parameters

The panel tab allows users to specify the desired panel size, from a preset from manually setting up the skipped driver / sensor pins.
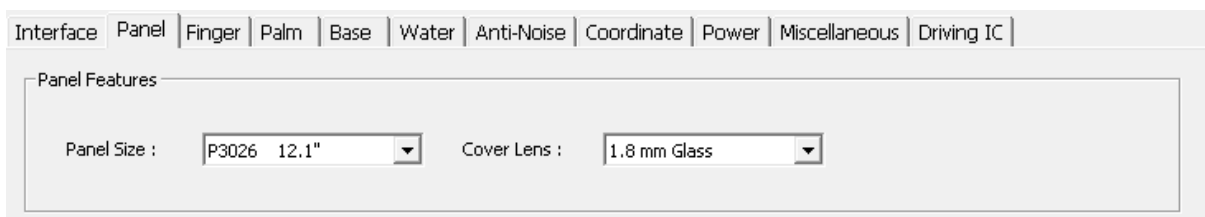
FIGURE 37

4.3.1   Choosing from a Preset

Standard PenMount firmware versions support a number of panel sizes and cover lens thicknesses. By selecting a preset, firmware will apply different configurations to parameters.
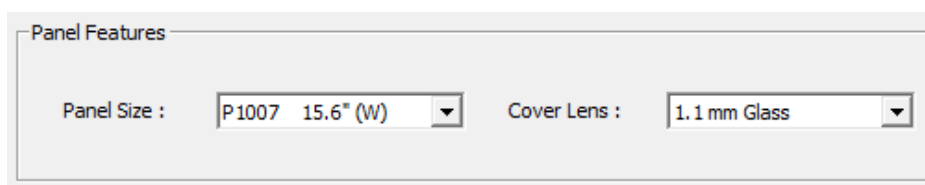
FIGURE 38

1. Panel Size

   Each PenMount firmware supports several panel size presets. For example, choosing the 'P3030 12.1" (W)' will setup firmware parameters to support the AMT P3030 12.1-inch touch panel.

2. Cover Lens

   Each PenMount firmware supports several cover lens thickness parameters, with the following standard thicknesses: 1.1mm, 1.8mm, 2.8mm, and 4.0mm. Please choose the nearest thickness from the list that most closely matches your cover lens.

4.4 Finger Parameters

The parameters in this tab are for tuning finger detection.
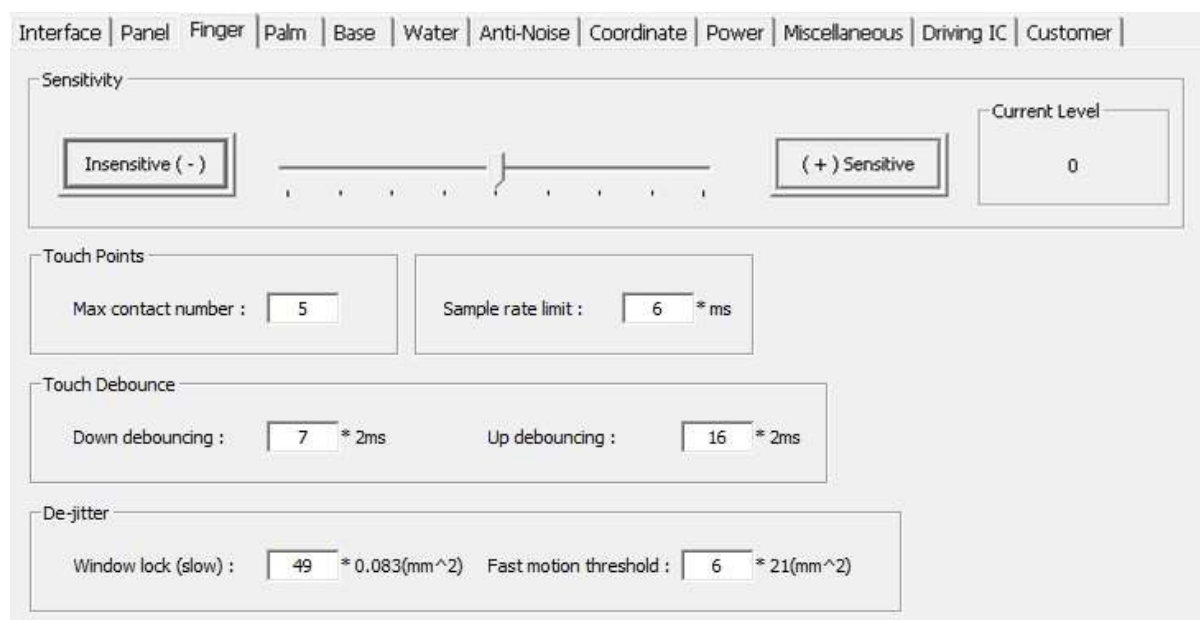
FIGURE 39

4.4.1   Sensitivity

Touch sensitivity can be adjusted with a slider. User can either use the slider or press the "Insensitive" and "Sensitive" buttons. By default, sensitivity level is 0, setting to positive values increases sensitivity and setting to negative values decreases sensitivity.

4.4.2   Touch Points

The maximum contact number limits how the number touch contacts reported to the system. For example, if the value is 1, the device supports single touch only, and other touch signals will not be sent to the system. This value will also be displayed in the Windows "System" Control Panel item.

Pen and Touch:	Limited Touch Support with 5 Touch Points

For standard PenMount firmware, this value is adjustable. But the maximum value range is still limited by the firmware default. For example, if the firmware can support a maximum of 5 contacts, users cannot set this value to 10.

4.4.3   Sample Rate Limit

By default, the sample (or reporting) rate is above 100 points per second for each finger, which guarantees a better touch experience. However, if used on slower systems, such as ARM, the system may not be able to handle so much data at one time, and data loss may result.

In this case, users can adjust the parameter value to lower the sample rate. The parameter generally makes the firmware sample touch data a fixed rate and the reporting rate for single touch can be approximately calculated with the equation below:

$$Estimated\ Reporting\ Rate = \frac{1000}{Sample\ Rate\ Limit\ Value}$$

For example, using parameter "10" means that the firmware will send touch data every 10ms, so ideally the reporting rate is about 100 points per second.

Please note that, although the value range can be 0 to 255, we recommend keeping the value under 20. Higher values mean more overheads. Since the firmware could have completed all necessary measurements, but it still needs to wait until the specified time ends to report the result.

4.4.4   Touch Debounce

The "debounce" parameters are used to filter out sudden touch state transitions caused by noise or unstable signals.

Basically, the firmware compares raw data value with a baseline value and, if their difference rises above a predefined threshold, it indicates that the touch panel could be in an active state. However, this can also be caused by noise interference, so that the firmware needs to wait for a certain period to ensure that the signal is stable. The same situation applies when the value differences drops under the threshold.
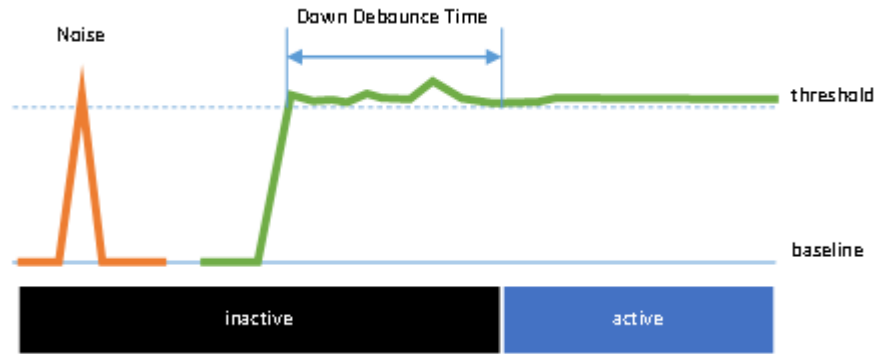
FIGURE 40

In some situations, the "Up Debounce" parameter could have a side effect that drops finger up events. This could happen when double clicking quickly, when the finger up period is so short that the second finger down event comes before the "Up Debounce Time" ends. In this case, users can lower the "Up debounce" parameter to optimize for double click operations.
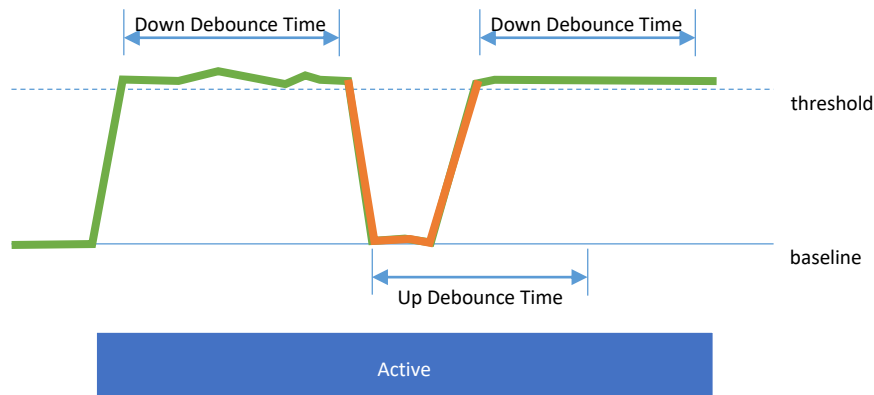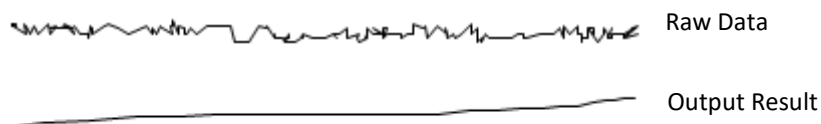

FIGURE 41

4.4.5   De-jittering

The PenMount firmware performs several smoothing processes which transforms jittery raw data into a smoothed result.

The "Windoਾ

FIGURE 42

1.   Window Lock (slow)

This parameter is used to avoid jitter within small movements. Any movement that is inside the range will be *locked* to the previous touch position. The parameter value is calculated as follows:

$$\text{Parameter Value} = (Lock\ Range)^2$$

For example, if parameter value is 49, it means that any movement less than 7 will be locked. The movement distance is calculated as:

$$dist^2 = dx^2 + dy^2$$

In the formula above, dx and dy each represents the offset on the x and y axis, and the resolution is the "pitch resolution" * X lines and "pitch resolution" * Y lines respectively[3].

"pitch resolution" * X

"pitch resolution" * Y

Lock Range

dist dy

dx
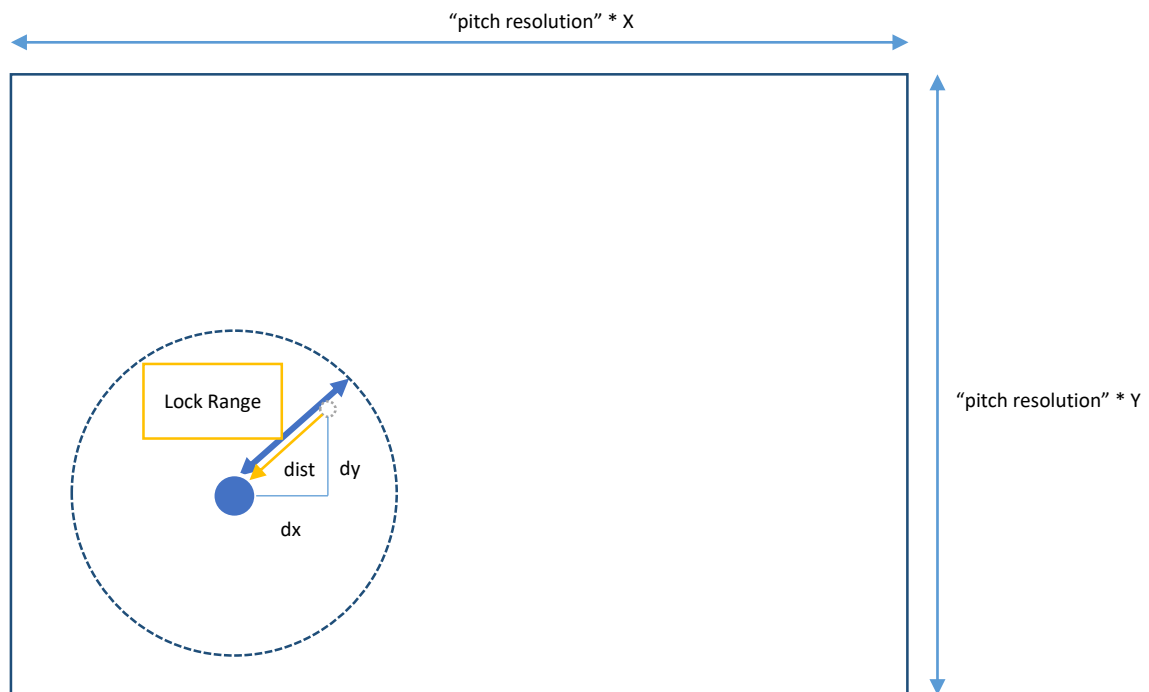
FIGURE 43

The parameter value can be set from 0 to 255. Larger values help avoid jitter in noisier environment but will also make it less easy to draw small objects.

2. Fast Motion Threshold

    This is used to help adjust the line smoothing algorithm when a finger is moving swiftly.

    For PenMount firmware, it should reference several previous points to calculate the current point position and make the output line as smooth as possible. In practice, it will need to reference more points when a finger is moving slowly and less points when a finger moving fast. The table below lists some presets used by PenMount:

Movement	Range	Points used for smoothing
Slow	<= Window Lock (Slow)	Window Locked
Normal	> Window Lock (Slow)	10

---

[3] The"pitch resolution" can be 16 for PenMount PM171x controller, and 32 for other P2-06 or P2-08 devices.

	<= Fast Motion Threshold	
Fast	> Fast Motion Threshold	4

The more points used for smoothing, the smoother the output line can be. However, the output points may be some distance away from the actual touch position, especially during fast movement. To balance these two considerations, users can adjust this parameter to control when the PenMount firmware will treat a movement as "fast" or "normal".

The parameter value is calculated as below:

$$Parameter\ Value * 256 = (\ Fast\ Range\ )^2$$

The DIP_RESO[4] value defines the unit. If the parameter value is 9, when moving a distance larger than 48 the firmware will treat it as a fast movement and use 4 points to perform line smoothing.

4.5   Palm Parameters

If the PenMount firmware supports palm rejection, there will be a "Palm" tab in the PCI Parameter utility. Palm rejection is used to detect and ignore large contact areas.
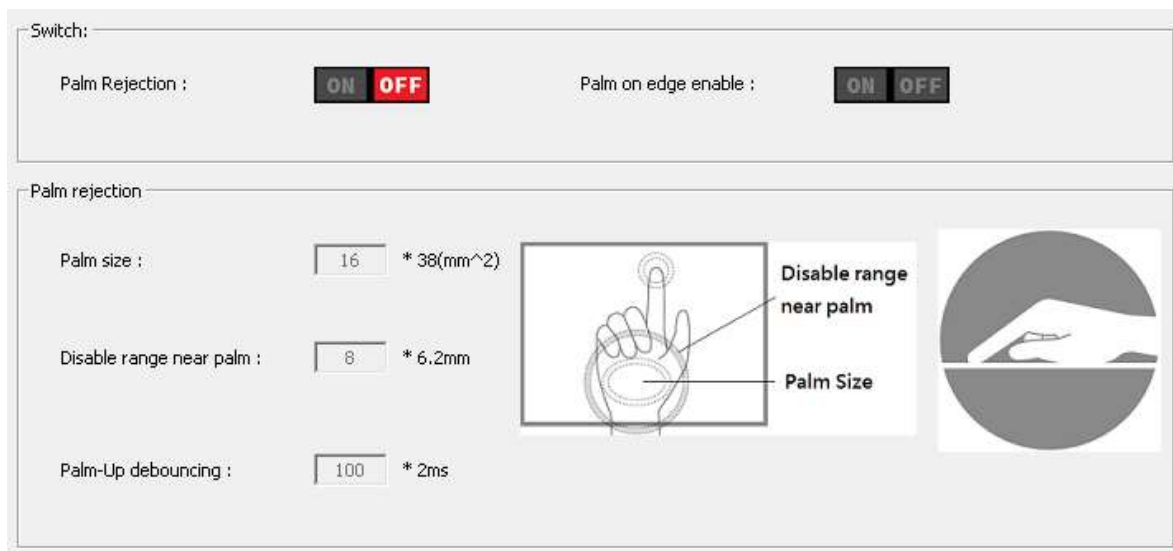
4.5.1   Palm Rejection

This is the overall switch for the firmware palm rejection feature. When this is turned OFF, all other palm features will be grayed out and a palm on the touch panel will be scanned and reported as touch event.

---

[4] The DIP_RESO value can be 4094 when using firmware V6.1 USB interface, or 2047 for any other case.

4.5.2 Palm Size

The palm "size" is the number of nodes on the touch panel are covered by a palm. The PenMount firmware will ignore signals within a "palm" object.

-5	-6	-11	-11	-12	-13	-18	-14	-12	-11	-13	-8	-14	-6
-4	-6	-7	-9	-13	-13	-9	-9	-12	-5	-7	-10	-7	-5
-11	-4	-7	-13	-15	-13	-13	-11	-6	4	3	-7	-9	-8
-6	-5	-2	-10	-7	-9	-20	-3	35	57	42	-3	-8	-6
-6	-3	14	28	7	-4	-10	25	55	62	53	12	-4	-24
-18	-5	48	74	63	39	43	43	26	23	28	23	-13	-14
-2	-5	3	27	41	52	58	64	36	23	34	17	-14	-6
0	-17	-5	-18	-11	39	73	57	52	48	48	5	-18	-15
-18	-8	-20	-24	-26	-14	25	48	55	51	52	7	-15	-12
-15	-17	-16	-30	-26	-17	-21	-12	18	54	59	17	-10	-13
-14	-14	-21	-19	-18	-19	-22	-19	-14	-5	-3	3	-19	-18
-10	-12	-11	-16	-18	-17	-17	-24	-23	-24	-17	-6	-5	-14

FIGURE 45

To tune palm size, please count the nodes that will be covered by palm-approximately. Using a value smaller than the palm size can cause firmware detect palm objects faster. However, the lower this value, the easier an object is treated as a "palm." This will also increase the chance of misjudgment when touching the panel with number of "thick fingers".

4.5.3 Palm Detection on Edge

PenMount firmware additionally supports ignoring unwanted touch signals generated by palms holding onto the edges of a touch panel.

After enabling "Palm on edge enable", the firmware will be checking any newly detected objects on the panel edge and will ignored it if its size is larger than a predefined threshold.

The threshold value used to detect large objects on edge is different from the "palm size" parameter in 4.5.1 because the object can be either a palm or finger. Currently the PCI Parameter does not support changing the threshold value.

0	-1	2	0	2	-1	4
-1	-2	2	8	9	6	1
1	4	2	26	67	24	7
4	-2	-1	52	104	97	36
0	4	3	26	92	107	85
1	0	2	2	18	37	68
-2	0	-1	3	2	8	11
0	2	2	-1	0	1	4

FIGURE 46

4.5.4 Disabled Range near Palm

To help avoid false activation by signals originating from a palm, PenMount firmware also ignores any nearby finger touches.
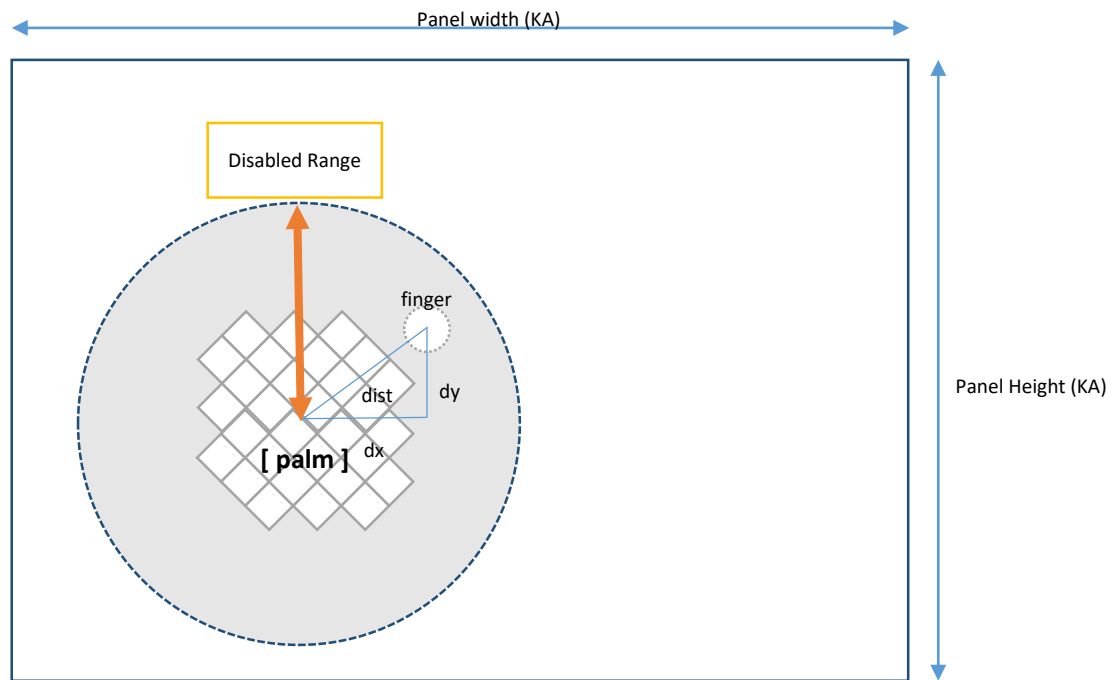
FIGURE 47

The "disabled range" can be calculated as follows:

$$Disabled\ range\ =\ \text{Parameter Value} * \text{Sensor Pitch}$$

Any finger at a distance from the center of the palm that is less than this range will be ignored.

4.5.5   Palm up De-bouncing

When a "palm" object is about to be removed from the touch panel surface, its decreasing size could also make it small enough to look like a normal finger touch. Without setting up a de-bouncing time for this, the firmware could send some unwanted touch data.

The "up-debouncing" time used for palms is different from the one introduced in section 4.4.4, since it will need more time to ensure that the palm object is completely removed. Please keep in mind, do not set this value too high because the palm area will be unresponsive to finger touches until the up de-bouncing ends.

4.6   Base Parameters

Base signals are the most important data for correctly detecting finger contacts. The PenMount firmware retrieves the base signal for the whole touch panel during initialization and updates the base value from time to time. The update should be configured to be frequent enough to catch up to environment changes but not be too frequent to affect the reporting rate.

FIGURE 48

4.6.1 Base Update Modes

The PenMount firmware will use one of the two supported update modes: standard mode or keep base update mode, depending on whether the water handling feature is enabled.

Water Handling Feature	Base Update Mode Used
Enabled	Standard Update Mode
Disabled	Keep Base Update (KBU) Mode

4.6.2 Standard Base Update Configurations

When the PenMount firmware uses standard base update mode, the base update process is shown in the flowchart below.
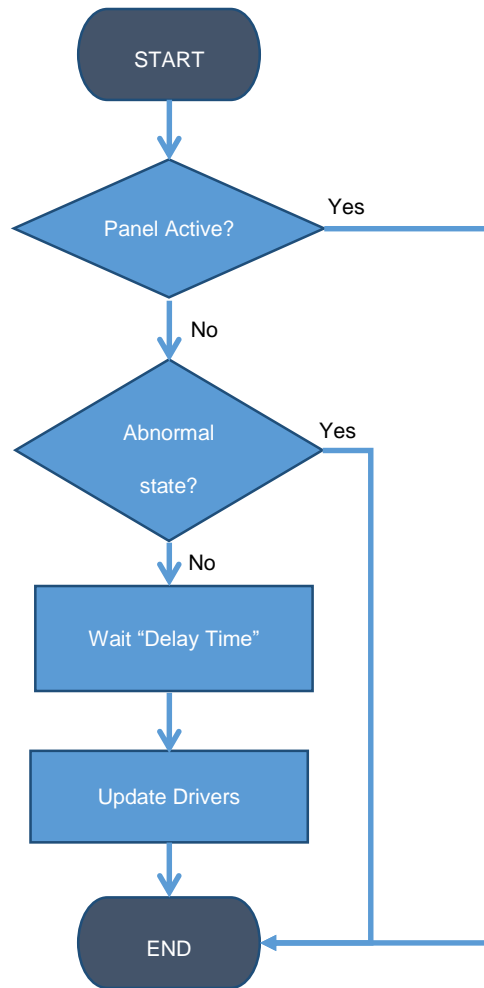
FIGURE 49

Water can be one of the causes of "abnormal state" and base update will not be performed until it is removed.

1. Start Update Delay Time

   The delay time (in 100ms unit) for PenMount firmware to perform base update after all finger contacts are removed and touch panel becomes inactive.

2. Update Driver Number

   By design, the PenMount firmware performs base update incrementally, only updating nodes on several driver pins each time. The number of driver pins to be updated is configurable from 1 to 16.
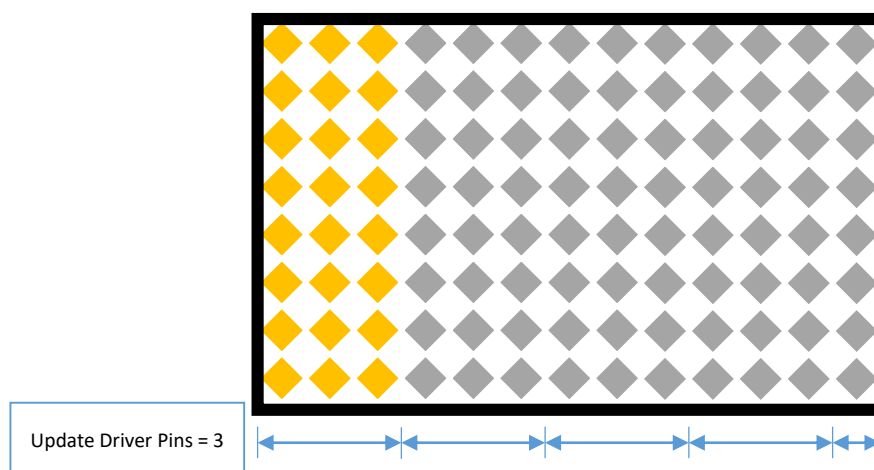
FIGURE 50

Updating more driver pins at one time may facilitate water handling or noise suppression. However, since updating more nodes means taking more time to finish, it might affect finger down response latency. In this case, please consider using smaller values for better response time.

4.6.3   Keep Base Update (KBU) Configurations

If water features are disabled, the PenMount firmware will enter "keep base update" mode.

In this mode, base signals are updated both when touch panel is active and inactive. The PenMount firmware uses "low pass filter" (described in 4.8.1) to prevent base signals from changing rapidly, so it will take several rounds for the base signal to be completely updated.

The parameters used are summarized in the table below:

Touch Panel Status	Updated driver pins each time	Delay Count
Inactive	The "Update Driver Number" parameter	Inactive Update Delay Count
Active	1	Active Update Delay Count

The "Delay Count" parameters control the update frequencies when touch panel is active or inactive. Since the firmware code structure is basically an infinite loop that keeps doing the same check routines, more delay counts mean more loops before performing one base update operation.
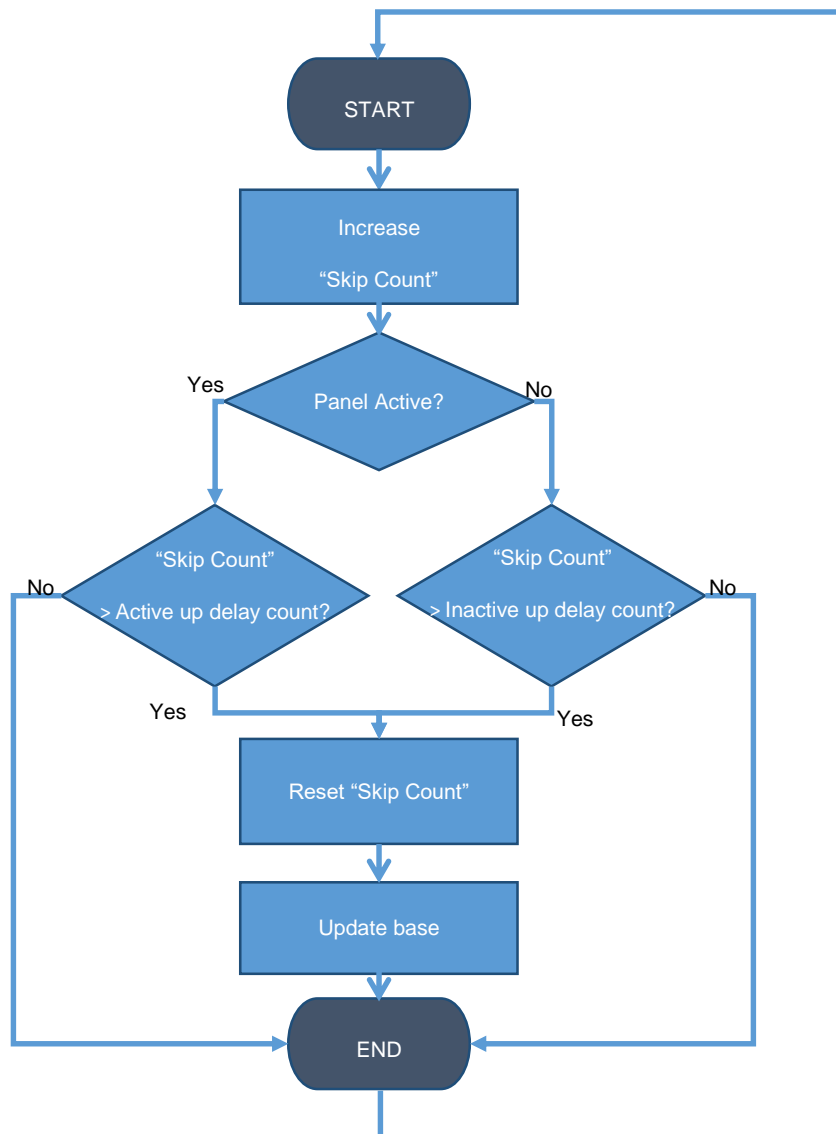
FIGURE 51

Tuning the "Active Delay Count" parameters to a proper value is extremely important. When using smaller delay count values, signals can adapt to environmental changes faster. However, since firmware keeps updating the base signal even when fingers are present, these finger signals will also be updated to become the "new base signal" eventually. In practice, user can see unexpected finger up data after press and hold in a small area for a short time.

4.7   Water Handling

The water handling feature includes choosing between different modes and tweaking parameters to compromise between performance and reliability.

4.7.1   Choosing a Water Handling Solution

The PenMount firmware supports two different water handling modes: Water Detection (WD), and Water Performance (WP).
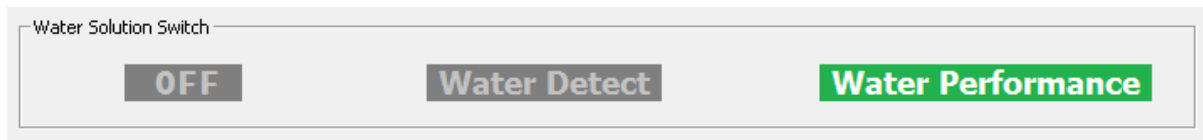
FIGURE 52

Users must choose one of the supported modes, or "OFF", if water handling is not the main concern.

Modes	Water Handling
Water Detection Mode	Stop reporting all touch data
Water Performance Mode	Supports touch in dry area, lock to single touch if water can cause false touch points

Please notice that when choosing WD or WP, building system reference is required to prevent unexpected behaviors during environmental changes.

4.7.2   Tweaking Water Performance Mode

The main feature of Water Performance (WP) mode is that it can eliminate false touch points caused by water. If false point signals keep appearing, it will cause firmware to enter a "critical state" where single touch can still be utilized in the worst case.

The parameters listed in the "Water" tab are for tuning water performance reliability.
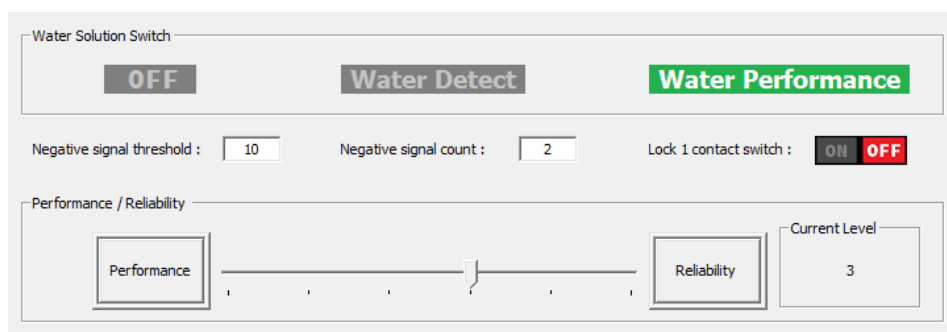
FIGURE 53

1. Lock 1 contact switch

    By default, the firmware automatically switched to single point touch mode to eliminate false touch signals. When this feature is turned OFF, the firmware does not enforce single touch mode, but it will not guarantee multi-touch results when water is present.

2. Compensate Between Performance and Reliability

    This is the main control for Water Performance mode. The settings are listed in the table below:

Reliability Level	Description	Touch Mode	Use Negative Signal Check
0	Some false touches to retain touch performance	Multiple touch in dry area; Switch to single touch mode after false touch detected	YES
1	Improved line drawing in dry areas with very little reliability drop		
2 (recommend)	Good performance in dry areas		
3 (default)	Better reliability by locking to single touch	Locks to single touch mode if there is water	
4	Good for harsh environments with saline, metal, or other conductors on touch panel surface		No
5	Very strict water verification that sacrifices performance		

Unless there is extreme concern regarding performance or reliability, we do not recommend setting to level 0 or 5.

3. Tuning the Negative Signal Check Parameters

Since any touch point can be a false touch caused by water, the PenMount firmware performs several checks to filter out normal touches and those that may be caused by water.

To compensate for performance, a negative signal filter is used to quickly filter out normal touches. This is designed with a basic assumption that false touch points are always surrounded by water, which comes with a negative signal.

Please note that for above 3, the PenMount firmware will not use this filter, and will always use stricter rules to check all the touch points for false touches.

A. Check Rules

The firmware checks negative signals around a touch point candidate. It will check count those that are more negative than the "Negative Signal Threshold" and, only if the amount is more than "Negative Signal Count", the firmware will proceed with further false touch verification.
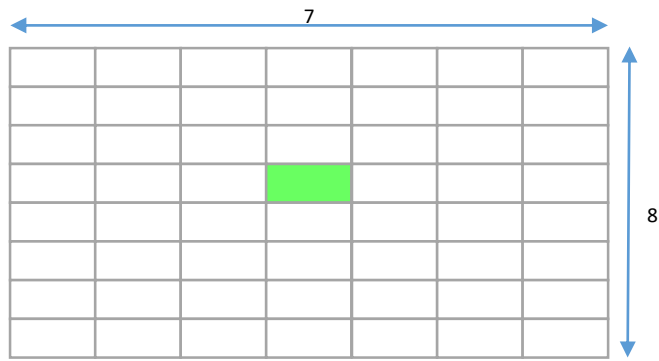
FIGURE 54

B.   Pass Sample

In the following sample, there is no negative signal around the touch point (in green), so this point is identified as a normal touch.

-4	1	4	4	1	4	3
-2	0	-4	-2	-2	0	-5
-3	-1	9	25	9	1	0
3	8	42	101	36	5	6
5	3	29	67	21	6	-1
1	1	3	9	-1	-4	-5
6	5	0	3	0	0	-1
5	-1	2	-2	-1	0	-5

FIGURE 55

C.   Fail Sample

In the following sample, the number of negative signals (in red) with values more negative than the "Negative Signal Threshold" is larger than the "Negative Signal Count", so it can be a false touch point and will require further verification.

9	-8	-15	-16	-15	-29	-15
24	19	-22	-29	-30	-33	21
-14	18	15	-10	-11	-7	-6
-46	-6	34	44	37	1	-23
-14	-15	-4	14	23	27	-3
-1	-12	-14	-21	-4	37	20
-5	-8	-8	-9	-14	0	31
-4	1	-1	-7	-4	0	1

FIGURE 56

Normally using the default parameter values are quite enough and it is only necessary to change them for stricter requirements.

4.8 Anti-Noise Parameters

In anti-noise parameter tab, users can configure the "Low pass filter" and switch "Enhanced Driving" to decrease the impact of noise.
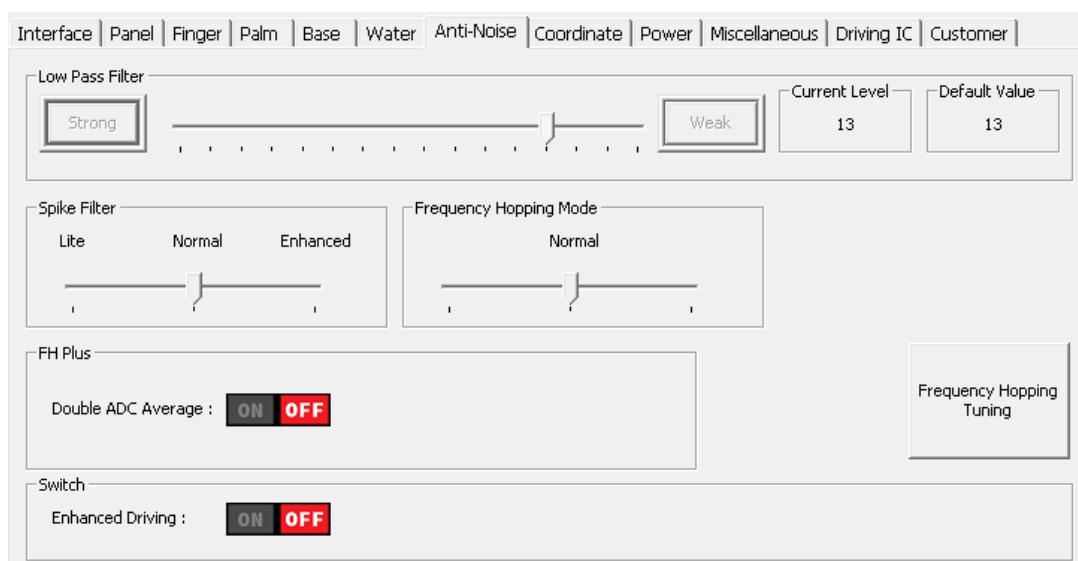
4.8.1 Configure Spike Noise Filtering

The PenMount firmware may use one of the following noise filtering methods:

Firmware Support	Spike Filter Settings		
	Lite	Normal	Enhanced
V6.2 and later	V	V	V
V6.1 and later	V		V
V1.0 and later	V		

Both methods are designed for eliminating the influence of noise jitter, and "Spike Filter" can give better result when dealing with ESD.

The "Low Pass Filter" setting will only be effective if "Spike Filter" is switched to "Lite" mode. Choosing a stronger value of "Low Pass Filter" will cause slower signal changes. The lower filter value can affect the base update time in KBU (keep base update) mode, so it needs to be fine-tuned for the best result.

Low Pass Filter	Keep Base Update Speed
Weak	Fast
Strong	Slow

4.8.2 Enhanced Driving

Enable enhanced driving for noisy environments, thicker cover glass, or glove touch to achieve better SNR and finger resolution at the expense of accuracy on the edge.

4.8.3 Configuring Frequency Hopping

The frequency hopping is most important for anti-noise.

4.8.3.1 Frequency Hopping Mode

The Frequency Hopping Modes Options provide user to leverage between touch performance and anti-noise.

Firmware Support	0 Lite	1 Normal	2 Enhanced
V6.2 and later	V	V	V
V6.1 and later		V	V
V1.0 and later		V	

4.8.3.2 Advanced Frequency Hopping Options

Firmware V6.3 further supports some advanced frequency hopping features such as the Double ADC Average. This is another Feature that supports pulse type noise suppression.

4.8.3.3 Frequency Hopping Tuning

Choosing a good value for the touch firmware's drive wait parameter can greatly improve touch stability, especially when other anti-noise parameters are turned OFF for fast drawing. The "Frequency Hopping Tuning" can help evaluate a good value for the "Drive Wait" parameter after a series of data collecting. Will ask for user input during the evaluation.

The utility will prompt for the following options before proceeding the evaluation process. Using the default values are good for most cases.

Figure 58

A.   Options

■   Current Drive Wait

The current drive wait parameter value used by touch firmware.

■   Minimum / Maximum Drive Wait

The range of "Drive Wait" parameter values to be evaluated.

- ■ Scan Count

  Controls the accuracy for "Drive Wait" evaluation.

- ■ Minimum Filter

  If this option is checked, the utility will automatically hide drive wait evaluation results that could make touch scanning unstable under certain circumstances, therefor the candidate values will be fewer.

- ■ Test Pattern

  Provide different background patterns during testing. The checkboard pattern shall be the strictest test environment, however, if no candidate found, please use white or black test pattern depending on the type of LCD.

B. Procedures

- ■ After pressing "Start", the utility enters the data collection phase. Please follow the instructions on screen to touch and release finger.
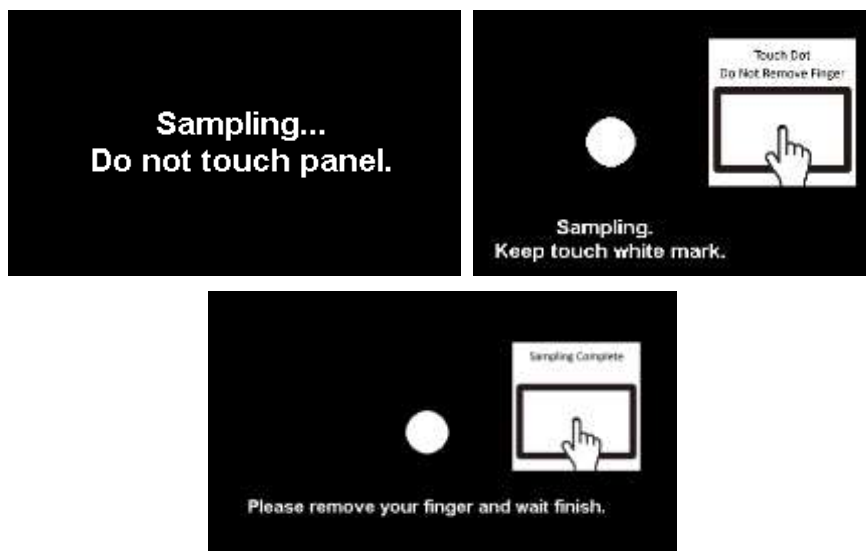
Figure 59

- ■ After evaluation finishes, the utility will automatically select one of the candidate drives wait values as the new parameter. The evaluation result is marked with different colors.
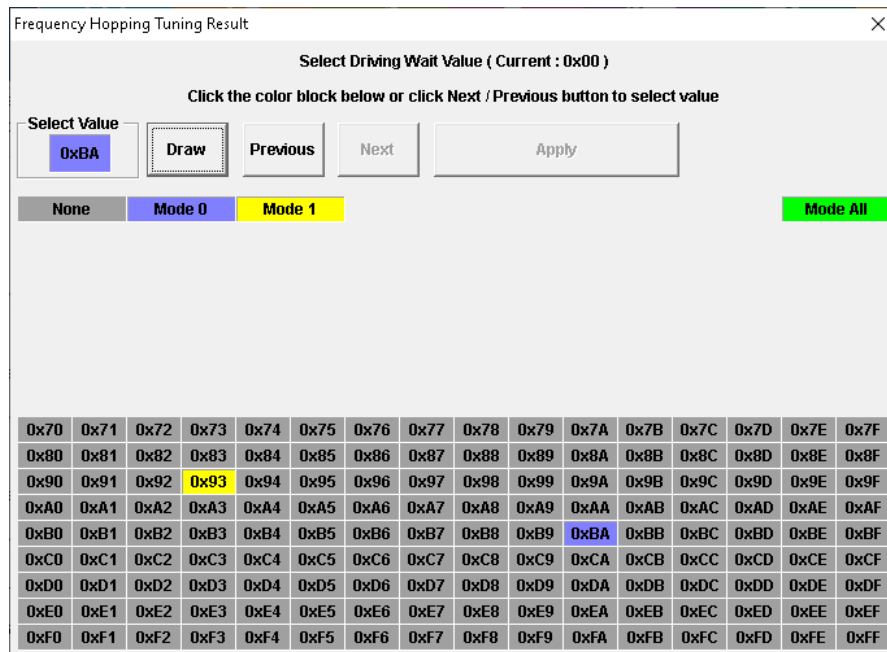
Figure 60

Cell Color	Description	Candidate
Green	Drive Wait value good for all FH modes	YES
Blue	Drive Wait value good for FH mode 0	YES
Yellow	Drive Wait value good for FH mode 1	YES
Grey	Drive Wait value not good for all FH modes	NO

■ Draw Button: Test touch function with selected driving wait parameter candidate.

■ Previous / Next Button: Use to navigate between different driving wait candidates.

■ Apply Button: After Draw button is pressed, and test result meets requirement, use this button to apply new settings.

■ X Button: To abort the evaluation process.

4.9 Coordinate Parameters

After the PenMount firmware applies low pass, smoothing, and other filters to the sensed touch data, it will proceed to the final step according to the parameters in the "coordinate" tab to map data to the user specified display size, before sending them to the system.
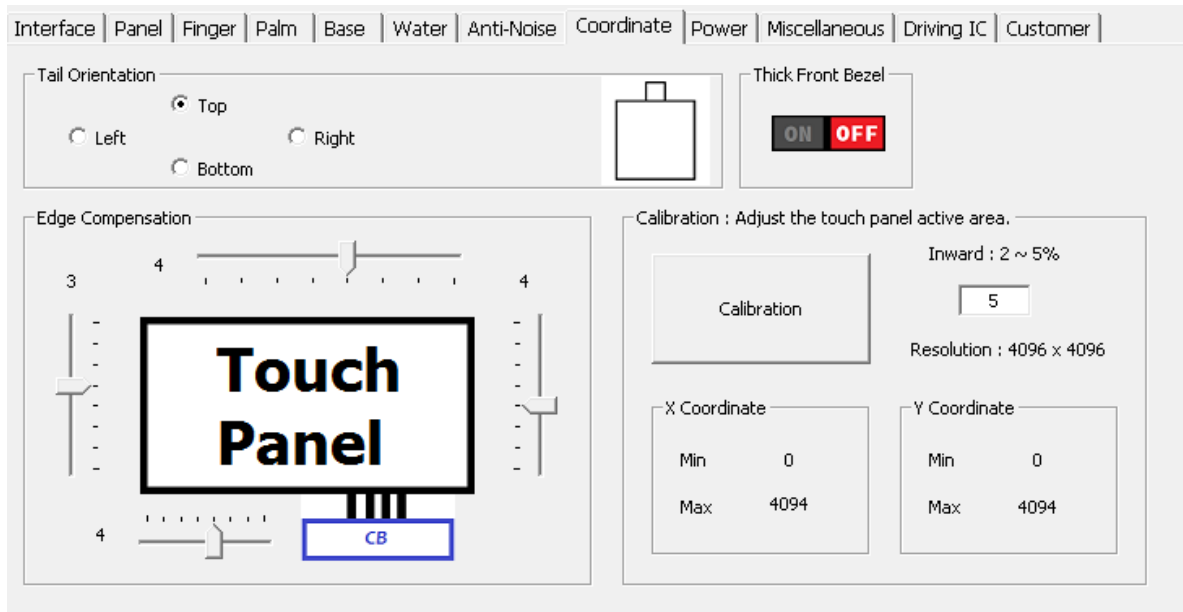
FIGURE 61

4.9.1 Calibration

Although the term "calibration" for some PCAP devices means calibrate the "base signal" for the current environment, for PenMount it means calibrate the coordinates of the touch area to match the user defined region.

By default, the PenMount firmware maps the whole touch panel active area to the display, meaning when touching the top left corner, it sends (0,0) as its position, and sends (RES_X, RES_Y) for the lower right corner.

FIGURE 62

There are two common cases that need calibration:

(1) When Touch panel is larger than the LCD

On systems that use touch panels larger than the actual display size, the display will be mapped to the part of the touch panel from (min_x, min_y) to (max_x, max_y).
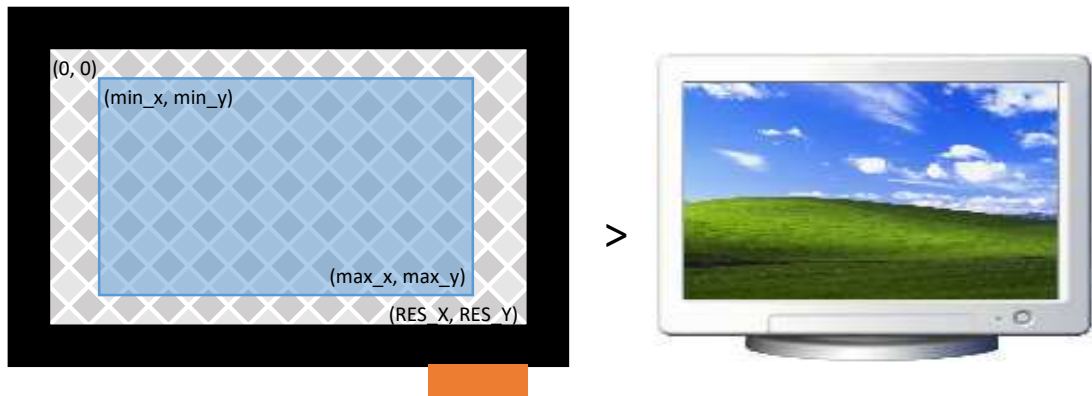
FIGURE 63

(2) When Using Front Bezel

On systems with displays designed with a front bezel, it can be harder for fingers to reach the edges. The touch position reported by firmware is near the center of a finger, and in the following diagram, it's represented by min "min_x".
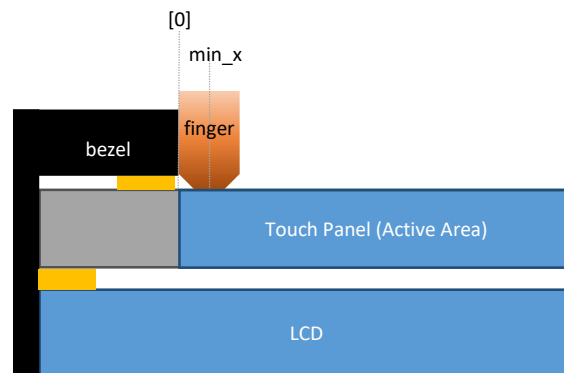
FIGURE 64

Calibration can be completed by:

(1) Manually setting up the minimum and maximum values for the X and Y axes.

The values should be calculated and converted to a 0 to DIP_RESO_X and DIP_RESO_Y[5] range.

(2) Pressing the "Calibration" button to launch the helper UI.

---

[5] The "DIP_RESO_X" and "DIP_RESO_Y" value can be 4095 when using firmware V6.1 USB interface, or 2047 for any other case.

4.9.1.1 Data Collection Stage

Please follow the instructions on screen by pressing the two red squares in top-left and bottom-right corner. The program will calculate the minimum and maximum values for the X and Y axes when finished.

width

height * 5%

width * 5%

Inward : 2 ~ 5%

5

Please click red target.

height
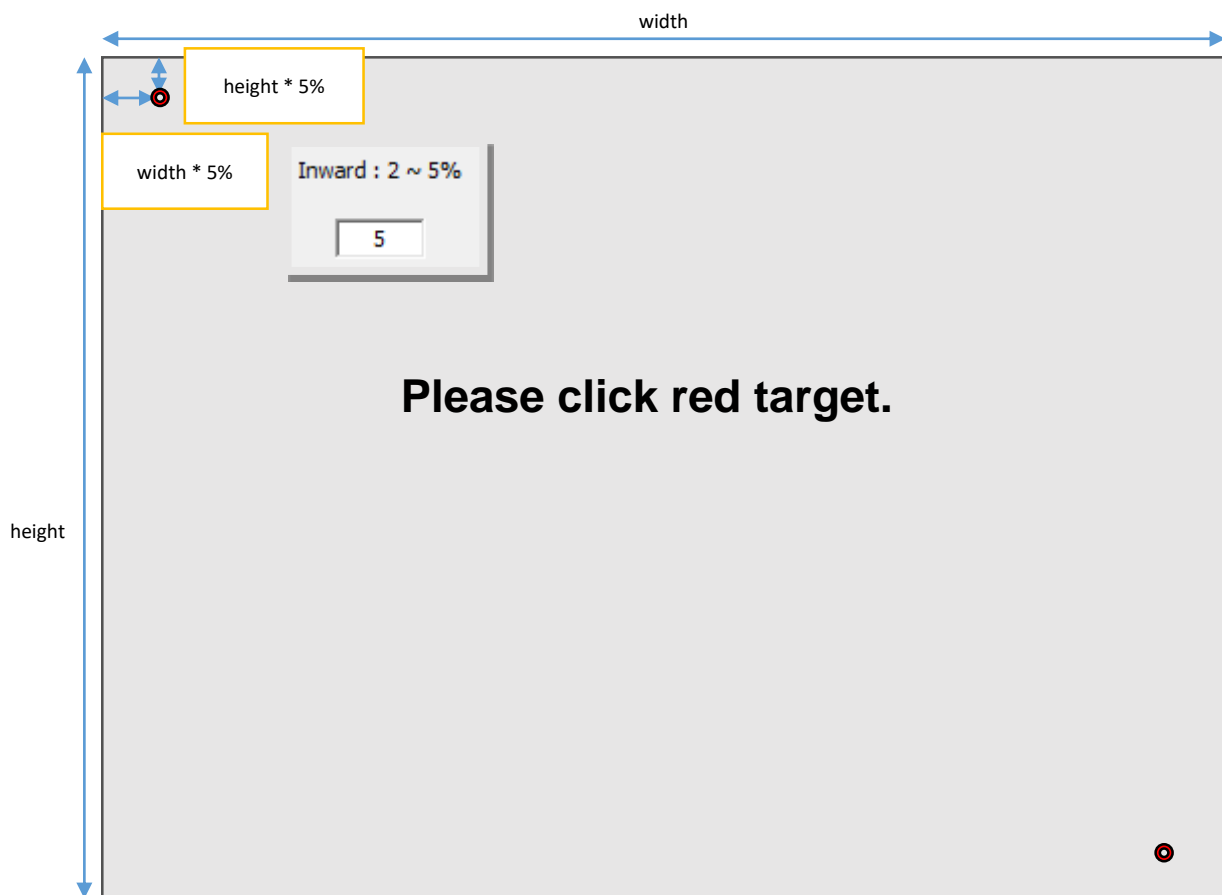
The "inward" setting helps users touch the red square easier, especially when performing calibration on a LCD with front bezels.

4.9.1.2 Test Stage

The calibration UI proceeds to the test stage after it collects the minimum and maximum axes values. During this stage, there is a third red square and users must press it. This stage can be skipped by pressing the F9 key. The firmware will automatically apply new settings if users skip the test, or when the test is successful.
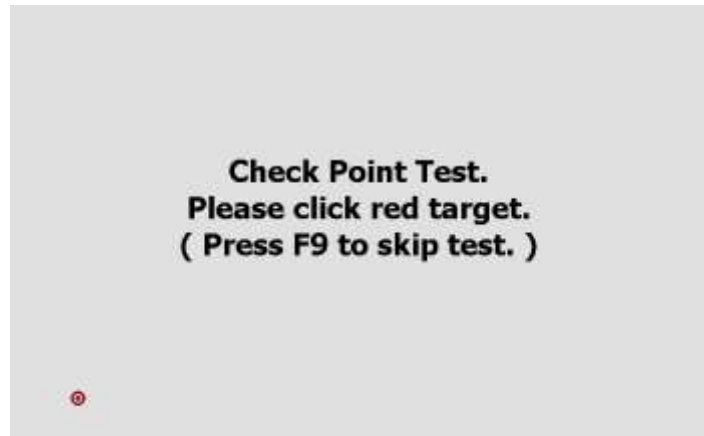
FIGURE 66

If the test fails, the program will prompt for another confirmation and users can still choose to apply the calibration result by pressing the "yes" button on screen.
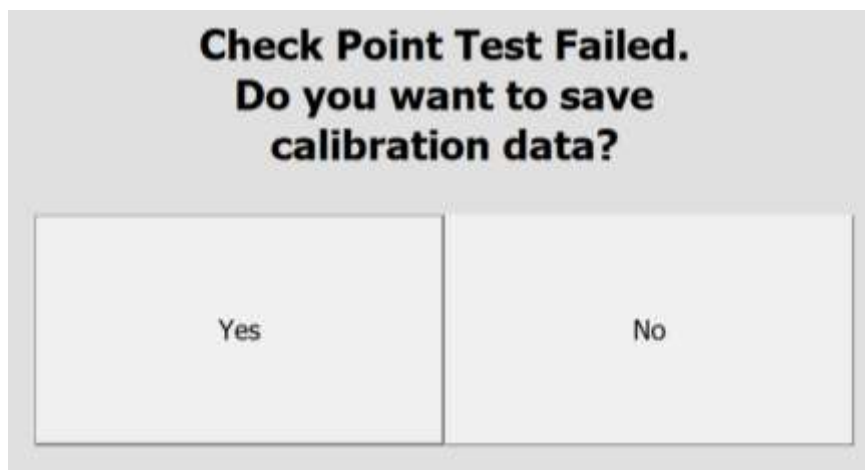
FIGURE 67

4.9.2   Edge Compensation

When the PenMount controller is released from the factory, the firmware's default active area setting for the LCD monitor corresponds to that of the touch panel and the active area sizes of hardware and software are the same. However, due to resolution, the active areas for hardware and software can be slightly different. To adjust this, please click "Edge Compensation".

When the edges of the touch panels do not function smoothly, please set the edge compensation value higher to improve functionality.

4.9.3   Tail Orientation

The firmware supports four rotational degrees compared to tail orientation.
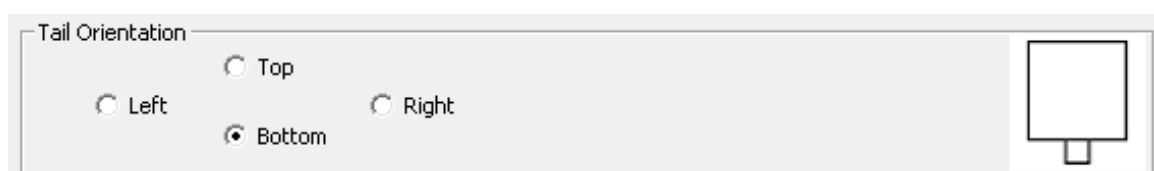
FIGURE 68

4.9.4 Thick Front Bezel Switch

This switch turns on or off the "Thick Front Bezel Support" feature available in firmware V6.3 and later versions.

4.10 Power Parameters

PenMount supports three power modes: Active Mode, Idle Mode, and Sleep Mode. The transitions are illustrated in the diagram below:
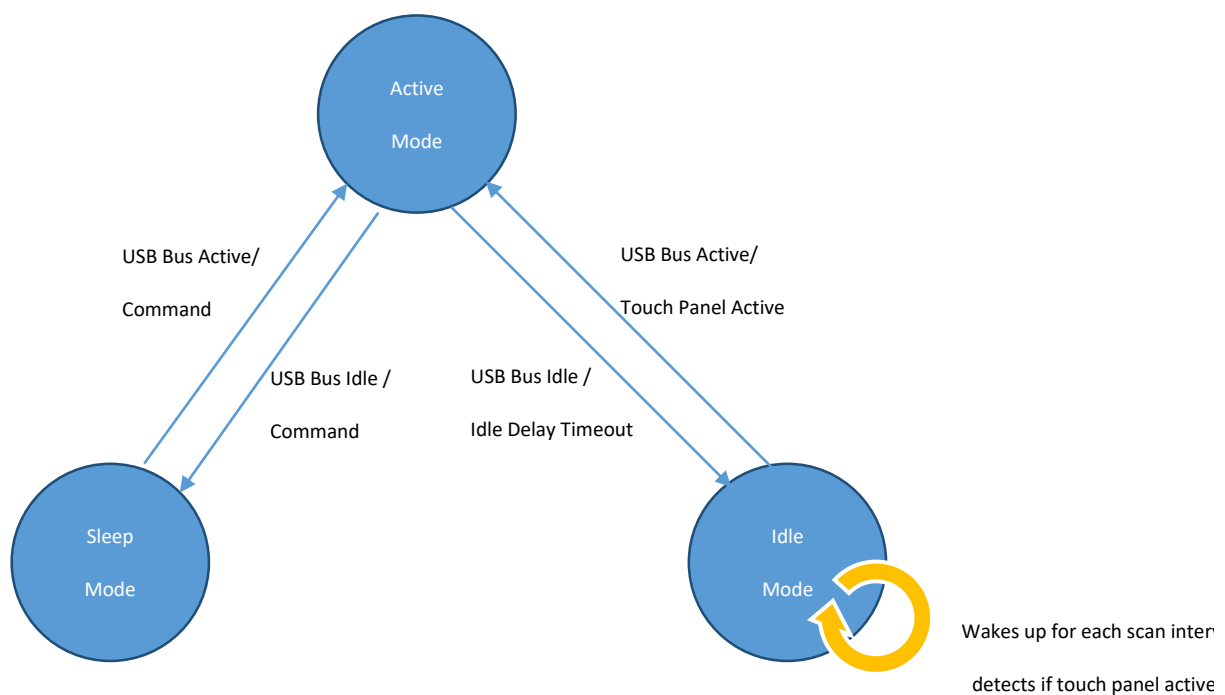
FIGURE 69

Both sleep mode and idle mode can be enabled or disabled with a PCI Parameter.
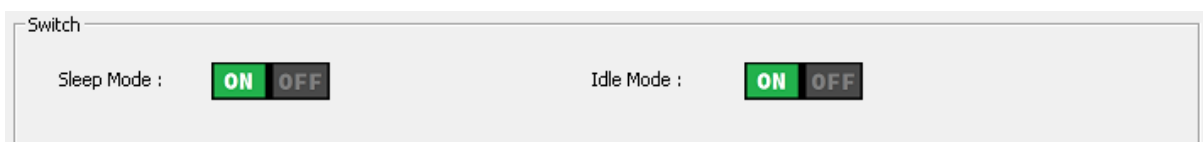
FIGURE 70

1. Idle Mode

    If enabled, the device will enter idle mode if it meets one of the following conditions:

    C. When remote wake up is enabled and USB bus becomes idle (USB interface only)

    D. When touch panel is inactive for a certain time period.

During idle mode, device wakes up from time to time to scan for touch signals. If the scan result is active, it will return device to active mode.

2.   Sleep mode

 If enabled, the device will enter sleep mode if it meets one of the following conditions:

E.   When remote wake up is disabled and USB bus becomes idle (USB interface only)

F.   When the device receives sleep command (RS-232 and I^2C interface only).

Once device enters sleep mode, touch will be disabled, and the device will only wake up when system resumes or when it receives any other command.

4.10.1 USB Interface Configurations

PenMount supports the USB "Remote Wakeup" feature and, when this feature is enabled, user can wake up the system by touch. For Microsoft Windows systems, this can be configured in the device's "Properties" page in "Device Manager".
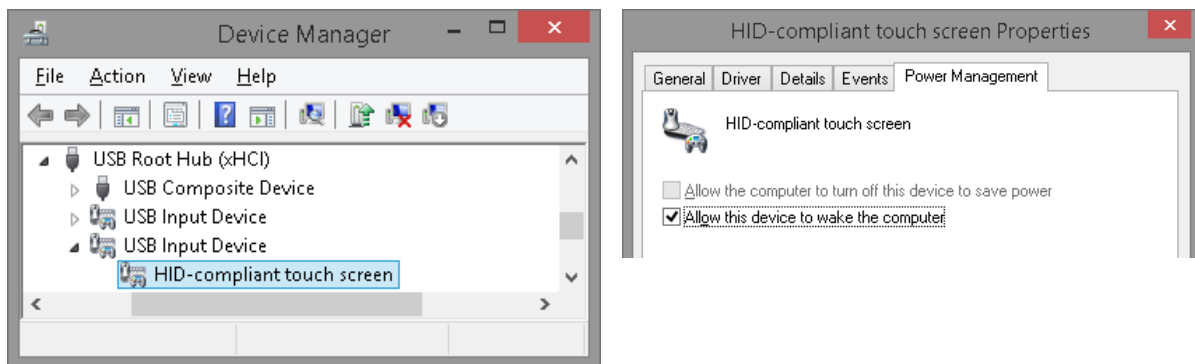
When the USB Remote Wakeup feature is enabled, it will also let PenMount device go into idle mode after system is suspended, otherwise it will go to sleep mode and will not wake up until system is resumed.

USB States / Remote Wake-up	Suspended States	Enabled States
Enable	Idle mode	Active Mode (With Touch)
Disable	Sleep mode	Idle Mode (Without Touch)

4.10.2 Idle Mode Settings

For idle mode, user can configure how fast the device becomes idle and how frequently it wakes up to scan for touch signals.

FIGURE 72

Power Modes	Scan Interval
Idle Mode	Configurable 10ms, 20ms, 30ms, 50ms
Sleep Mode	Scan Stops
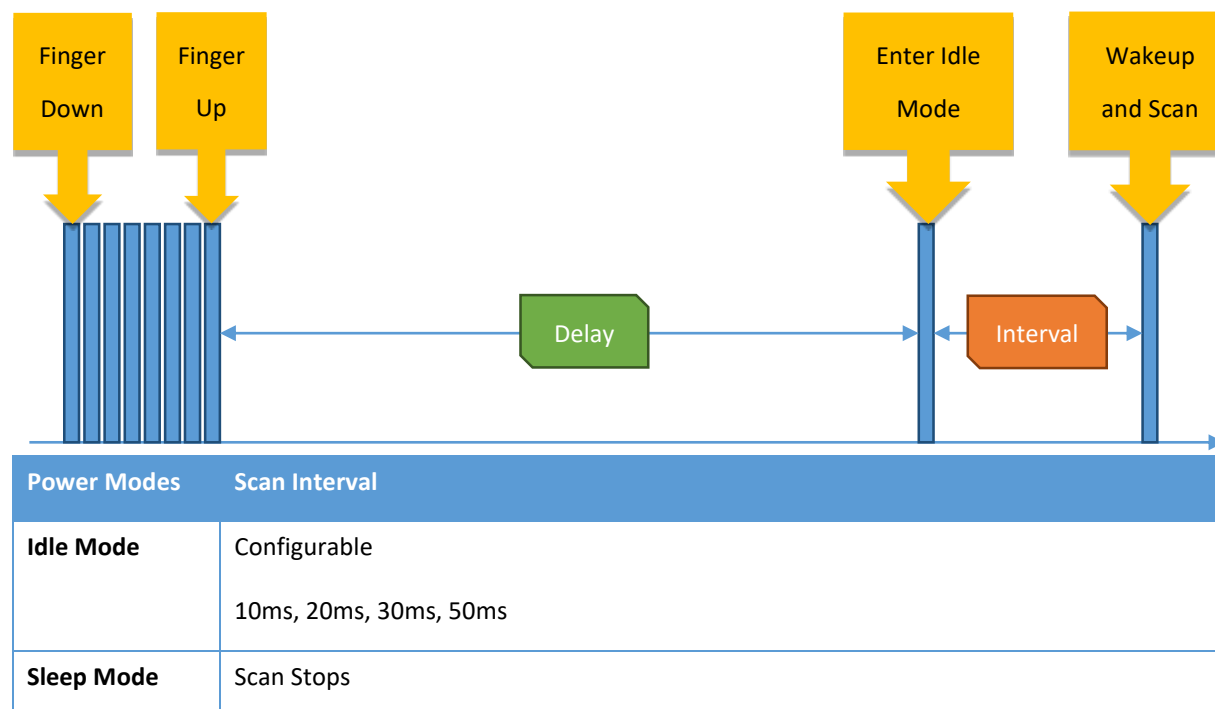
FIGURE 73

4.11 Miscellaneous Features

In the "misc" tab, users can enable or disable firmware supported features.
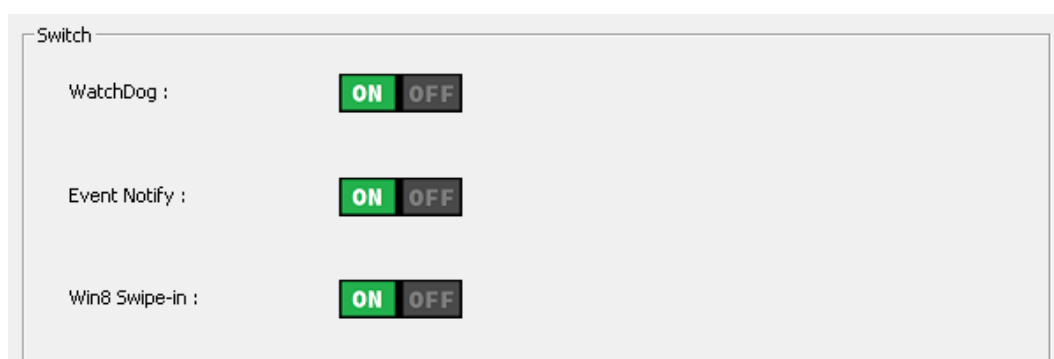
FIGURE 74

4.11.1 Watch Dog

When the watch dog feature is enabled, it will automatically reset device when it becomes unresponsive.

4.11.2 Event Notify

This switch controls two kinds of event notifications:

(1) The helper feature for "Water Detection" (WD) mode. When firmware enters an abnormal state, it will send a special notification data packet as the listed in the table below.

Interface	Abnormal Notification														
USB	State	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	Enter	0x01	0x8A	---	---	---	---	---	---	---	---	---	---	---	---
	Leave	0x01	0x0A	---	---	---	---	---	---	---	---	---	---	---	---
	Values of data byte 2 to 13 are not used and can be ignored.														
RS-232	State	0	1	2	3	4	5								
	Enter	0x8A	0x00	0x00	0x00	0x00	\<CheckSUM\>								
	Leave	0x0A	0x00	0x00	0x00	0x00	\<CheckSUM\>								
I2C	State	0	1	2	3	4	5								
	Enter	0x8A	0x00	0x00	0x00	0x00	\<CheckSUM\>								
	Leave	0x0A	0x00	0x00	0x00	0x00	\<CheckSUM\>								

The PCIUtility will be able to display warning messages after receiving this message.

If the device drivers in the operating system do not support this feature, receiving the message could cause some issues. In this case, please consider turning this feature off.

(2) When the "Touch and Halt" feature is enabled on the Debug Page, device will also send a notification when touch is detected. If it is turned off, the "Touch and Halt" button will also be greyed out and cannot be changed.

The data packet of the event notification is as listed in the table below.

Interface	Abnormal Notification													
USB	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0x01	0x8F	0x00	0x00	0x00	0x01	---	---	---	---	---	---	---	---
	Values of data byte 6 to 13 are not used and can be ignored.													

Interface	Abnormal Notification					
RS-232	0	1	2	3	4	5
	0x8F	0x00	0x00	0x00	0x01	<CheckSUM>
I2C	0	1	2	3	4	5
	0x8F	0x00	0x00	0x00	0x01	<CheckSUM>

4.11.3 Win8 swipe-in

Enables or disables the swipe from edge gesture support in Windows 8, 10, and Windows 11.

4.12 Driving IC Parameters

PenMount controllers use the driving IC to help improve SNR. Driving voltage and current limits can also be configured.
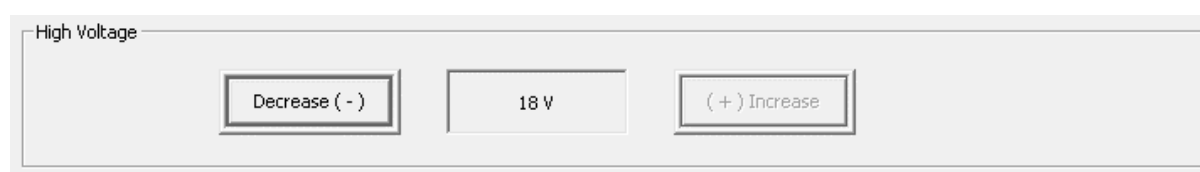
FIGURE 75

4.12.1 High Voltage

The default voltage used is 18V for better SNR. However, if using a higher voltage will affect system EMI testing results, please consider using smaller values. The supported voltage range is:

Driving Voltage	Description
18V	Default value
16V	

14V	
12V	
10V	
8V	Not recommended
6V	Not recommended

Please note that some voltages are not recommended, because the measured signal will be too small and can affect normal operation.

4.13 Customer Parameters

Some ODM firmware versions support special parameter settings requested by customer.

For example, the "Point Report Ratio", which controls the overall data report rate to enhance touch experience on slower systems, can be adjusted in the "Customer" tab.

FIGURE 76

5. Field Update

The field update page allows user to change controller firmware version.

FIGURE 77

5.1 Load Firmware File

Please press "Load Firmware" under "Field Update" and click the file you want to update in the dialogue box.
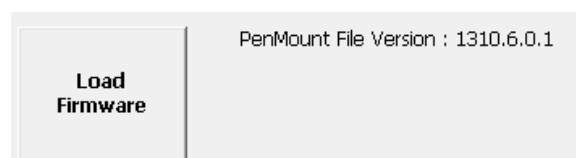
FIGURE 78

The format of the firmware supported by PenMount is suitable for

(1) "pmf", "pnf", or "pxf" format for one single IC

(2) "pmc", "pnc", or "pxc" format for multiple ICs.

(3) "pfp" format for combination of firmware and parameters.

The pfp file format that includes virtual button settings are also supported in this utility version, which may also display the CRC values of "Parameter", "ND Base", or "Virtual Key" when corresponding data is included in target file.

Parameters CRC in File : xA34C

ND Base   CRC in File : xE33C
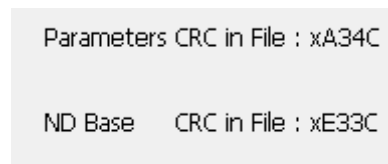
FIGURE 79

Please note, if the firmware file is not consistent with the controller connected during the update, the update will not proceed.

5.2 Update Firmware

After you load firmware files, please click "Update" button to proceed. There are two options available:

● Write Factory Default Parameters

This option is selected by default when updating with PMF or PMC file format. This option is not selectable when using PFP file format.

With this option set, firmware parameters will be reset to default values after update finishes. When only check this option, host interface / panel and other firmware parameters will remain unchanged.

● Write Host Interface / Panel Parameters

This option is only adjustable when "Write Factory Default Parameters" is turned ON. With this option set, host interface and panel parameters will also be reset to default values after update finishes.

During the update, all the button settings will be locked temporarily to prevent update failure due to inadvertent selection.

Load Firmware	PenMount File Version : 1310.6.0.1	Parameters CRC in File : x46A4
Update	☑ Write Factory Default Parameters ☐ With Host Interface / Panel Parameters
	Result : Now Programing. Please Wait 0.406(s)
Combine Firmware and Parameters	
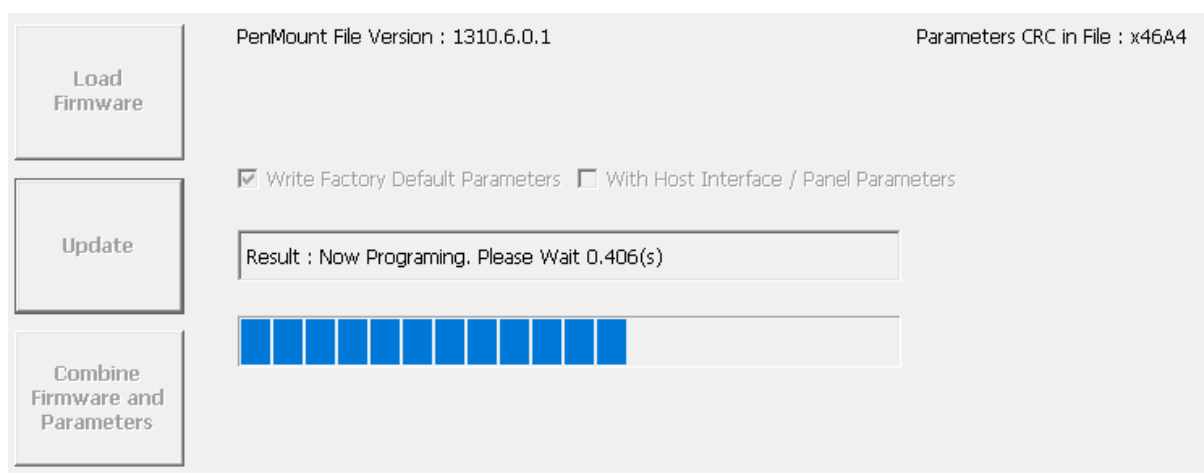
FIGURE 80

Please wait until update reaches 100%. During the update, please do not interrupt the power supply. After the firmware update is completed, you will see the "PASS" mark.
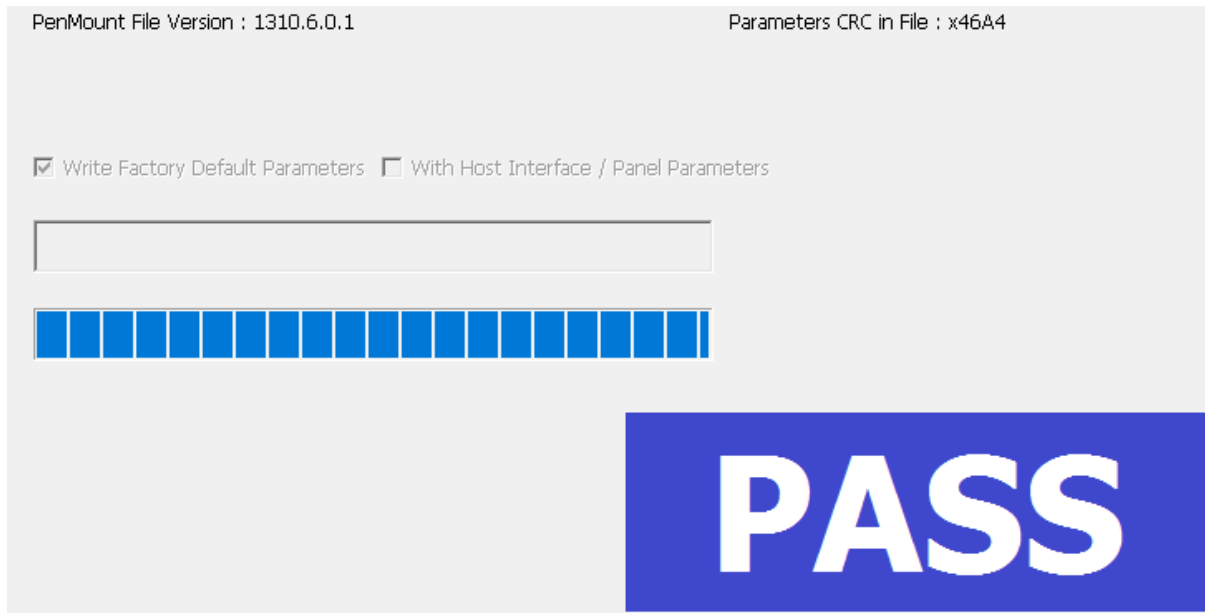
FIGURE 81

If the update fails due to an unavoidable factor, you will see the "FAIL" mark and the error messages.

FIGURE 82

If this happens, you will find firmware info remains in "Boot Loader" mode. You can click the "Update" button again to restart the update process.

5.3   Generate New PFP File

The utility can combine the parameters of the connected device with a base firmware file and generate new PFP files.

1. By default, the "Combine Firmware and Parameters" button is disabled, as shown in the figure below, when firmware file is not loaded yet.

FIGURE 83

2. Press the "Load Firmware" button and choose any firmware files that match the connected device.

   For example, if using PM1410 V6.3, any PXC o PFP files that is targeted for PM1410 V6.3 can be used.
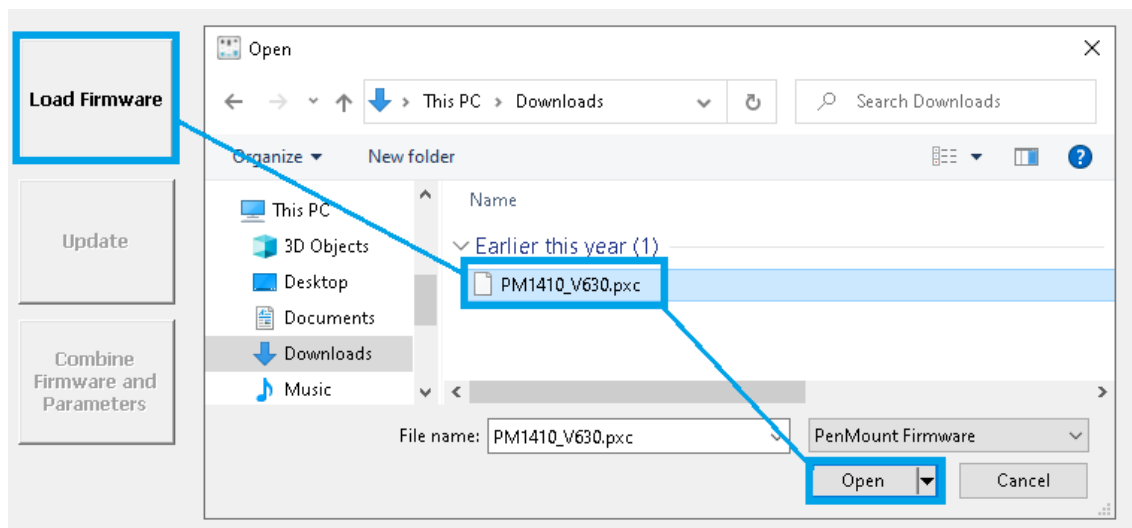
Figure 84

3. Press the "Combine Firmware and Parameters" button, and the utility shall create the firmware (.pfp file) with parameter CRC x908C in the same directory.
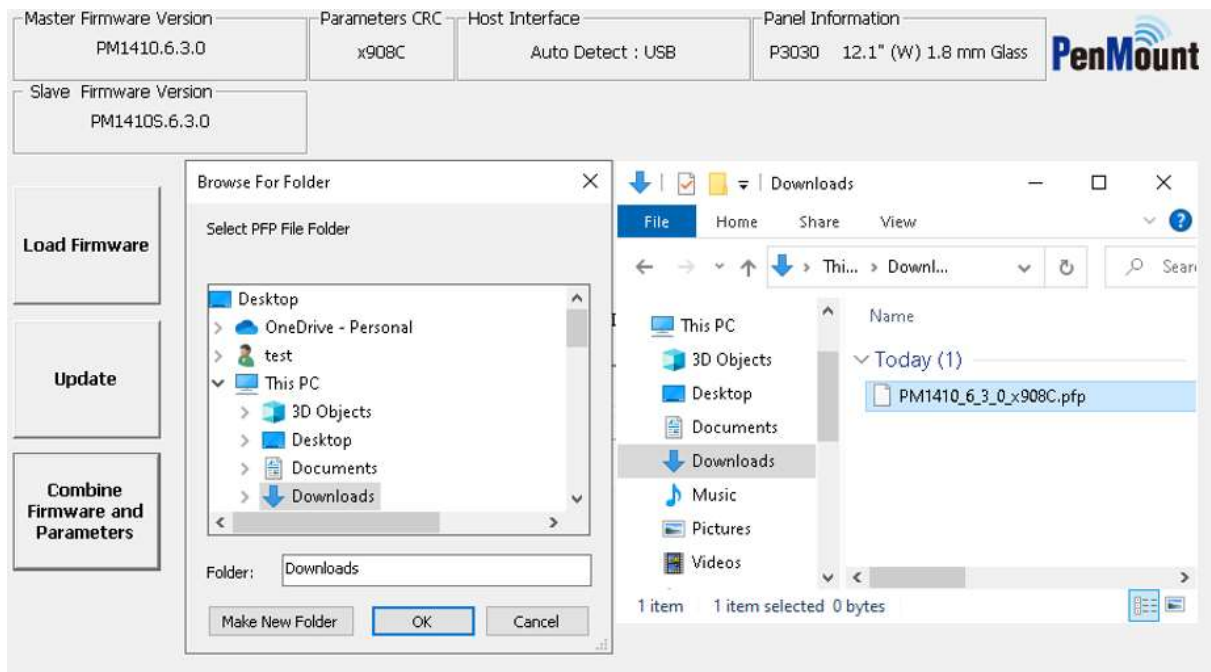
Figure 85

4. If there is no firmware of the same version that can be loaded, please select the "Export Parameter" button in the Parameters page and save the parameter as an .ini file. Please provide the file to PenMount team, and we will provide the firmware file with the same parameters.
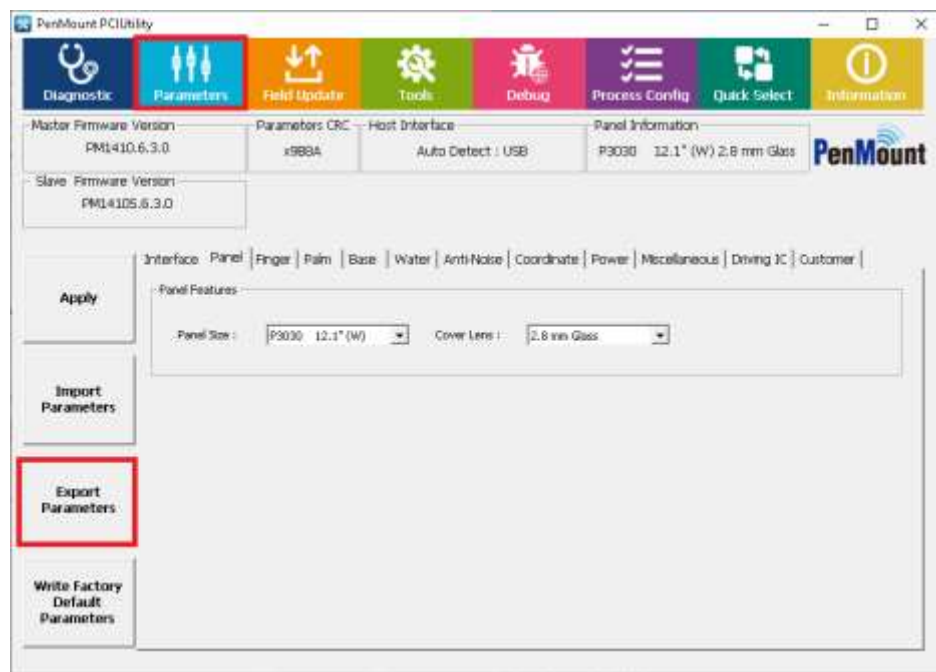
Figure 86

6. Tools

The Tools panel shows buttons that users can use to launch related tools.

Figure 87

6.1 Reset Device

Use this button to reset the connected PenMount P2 touch controller.

6.2 Draw

In Drawing mode, user can examine whether breaking or point hopping will occur when drawing lines and provides a mechanism for measuring sample rate.

Item	Description	
Operating systems	Windows XP and later versions	
Support Index1	1P	Black
	2P	Red
	3P	Green
	4P	Blue
	5P	Magenta
	6P	Cyan
	7P	Brown

	8P	Yellow
	9P	Purple
	10P	Orange
Switch to Draw Mode	"D" key	
Switch to Touch Mode	"T" key	
Sample Rate Test Hotkey	"S" key	
Clear Screen	"Space" key	
Toggle Full Screen	"F" key	

The program will show a white canvas in full screen mode, allowing the user to test the touch drawing feature. If you need advanced functions, please "Press and Hold" with your finger or click the right mouse button for the functions indicated below:
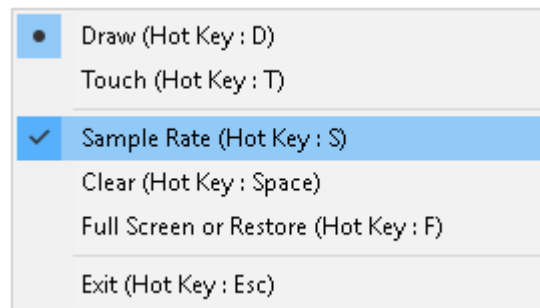
FIGURE 88

- Draw Mode

    Switch to draw mode. In this mode, the program will label touch points in different colors.
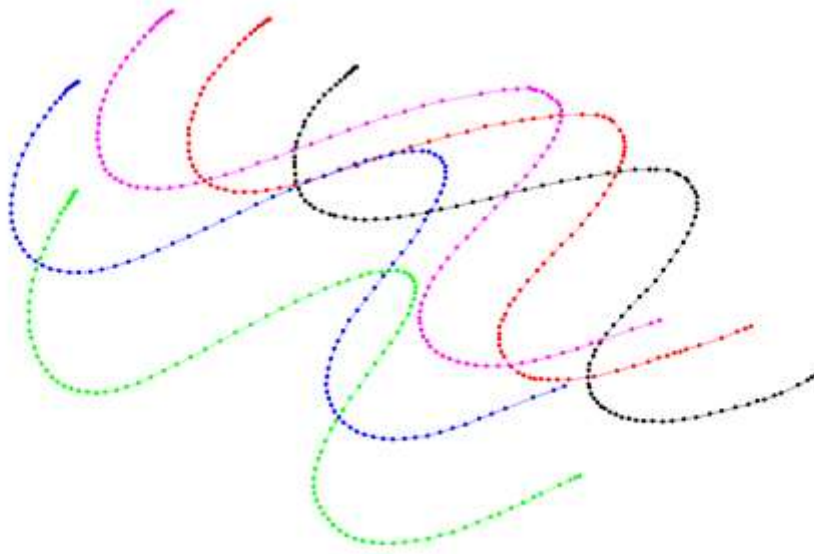
FIGURE 89

- Touch Mode

  Switch to touch mode. In this mode, only the touch point location of your finger is shown.
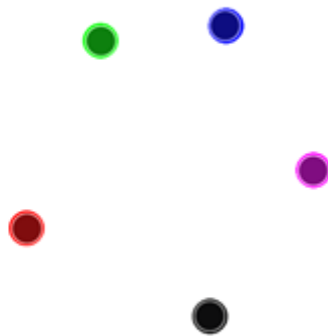
FIGURE 90

- Sample Rate

  After touch input, it will take approximately one second for the program to calculate and show the Sample Rate of each touch point. For example, Point 0: 116 means 116 points per second. When the Sample Rate is higher, drawing will be more precise.
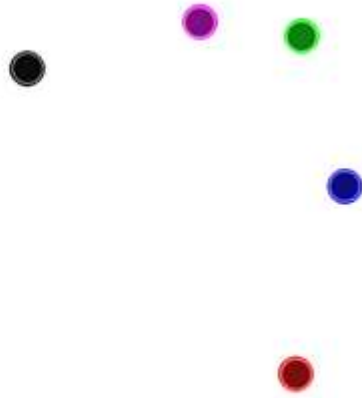
FIGURE 91

- Clear

  Clean the canvas.

- Full Screen or Restore

  Switch between full screen display and windowed display.

- Exit

  Exit the program.

Note: After entering Draw mode, please do not connect or disconnect devices. Otherwise, touch will not function.

6.3   Event Log

The Event Log button will launch the iBTEventLog utility, which provide different ways to log data for analysis.

After launched, an icon appears in taskbar notification area.

FIGURE 92

6.3.1 Check Event and Log File

Any detected events and log data will be saved to files in the sub directory of the iBTEventLog.EXE file.

Directory	Sub-Directory	Data
Event		Single Event / Status Event
Log	StatusEvent	FW Information logged by status event.
	Timer	FW Information logged by timer, matching condition.
	Condition	FW Information logged by touch condition.
	Manual	FW Information logged manually.

6.3.2 Stop Utility

The Event Log utility can be switched off in PCIUtility. User can also stop the utility by right click on the utility icon on taskbar and choose Exit in menu.
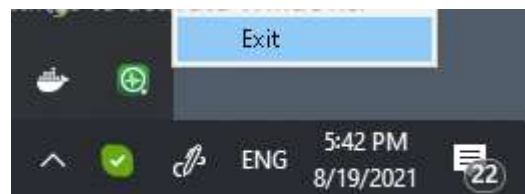
FIGURE 93

6.3.3 Setting

Right click on the utility icon on taskbar and choose Setting in menu.
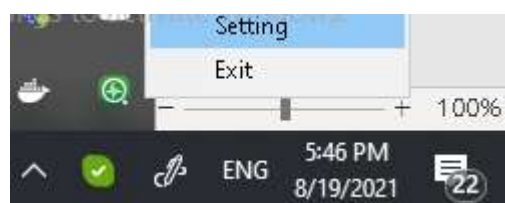
FIGURE 94

The Setting window of iBTEventLog utility will appear.

FIGURE 95

Please notice that the basic UI include common features supported by PenMount P2 V6.3 and later versions.

Please use the PenMount P2 firmware V6.4 and later for complete event logging support.

6.3.3.1 Timer

Enable to periodically log firmware information. Choosing larger Log Level values to log more information.

6.3.3.2 Conditions

Enable to log firmware information triggered by touch. Choosing larger Log Level values to log more information.

Type	Description
No finger but touch	Utility will log firmware information when touch detected.
One finger but more fingers	Utility will log firmware information when multiple touch detected.

6.3.4 Manual

Click on the button to log firmware information immediately.

6.4 Panel Config

The Panel Config button will launch the Panel Config utility, which provide interactive ways to setup touch panel parameters. Please follow the instructions to finish setup.

1. Make sure that touch panel is connected properly and press the START button.
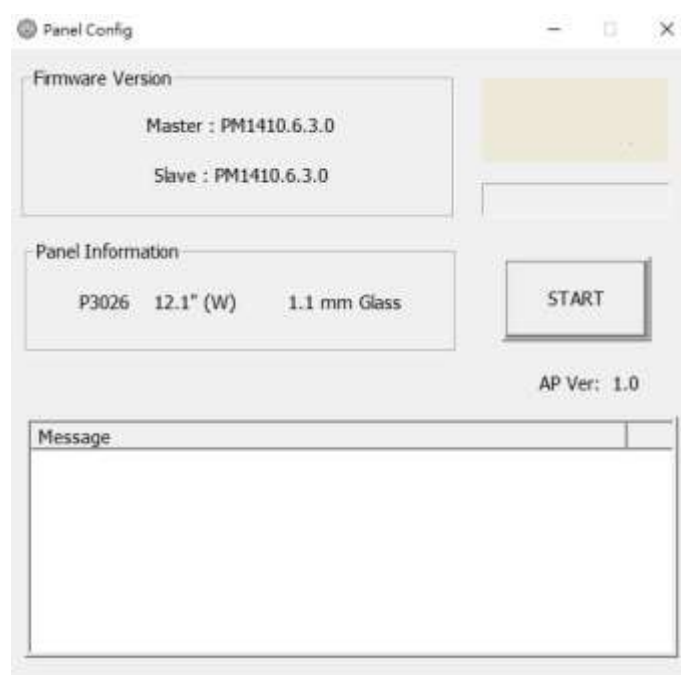
FIGURE 96

2. In Settings window, enter Panel Name, Cover Material, Cover Thickness, Panel Size and Tail Orientation respectively, then press the "Next >" button.
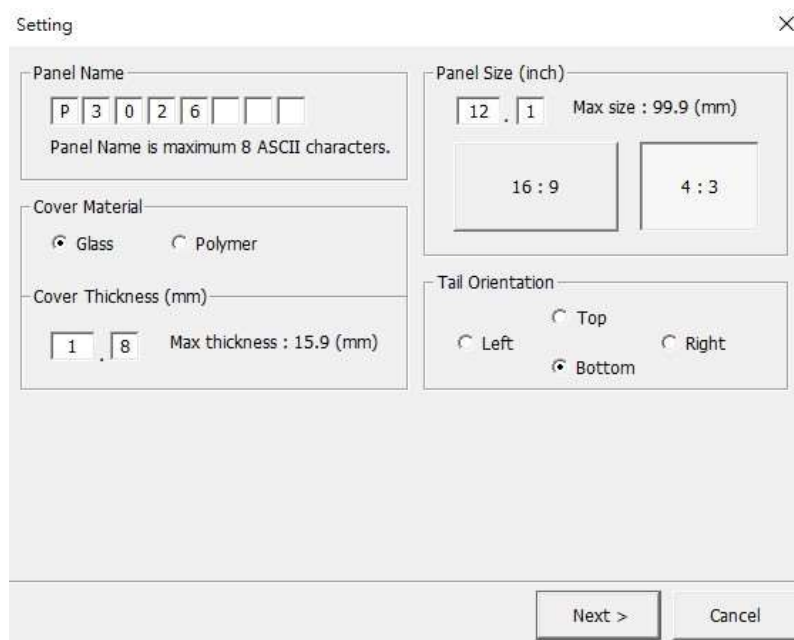
FIGURE 97

3. Check the touch panel specification and fill in the Key Area and Active Area information. Firmware use these settings to determine coordinate adjustments on edge.

Options:
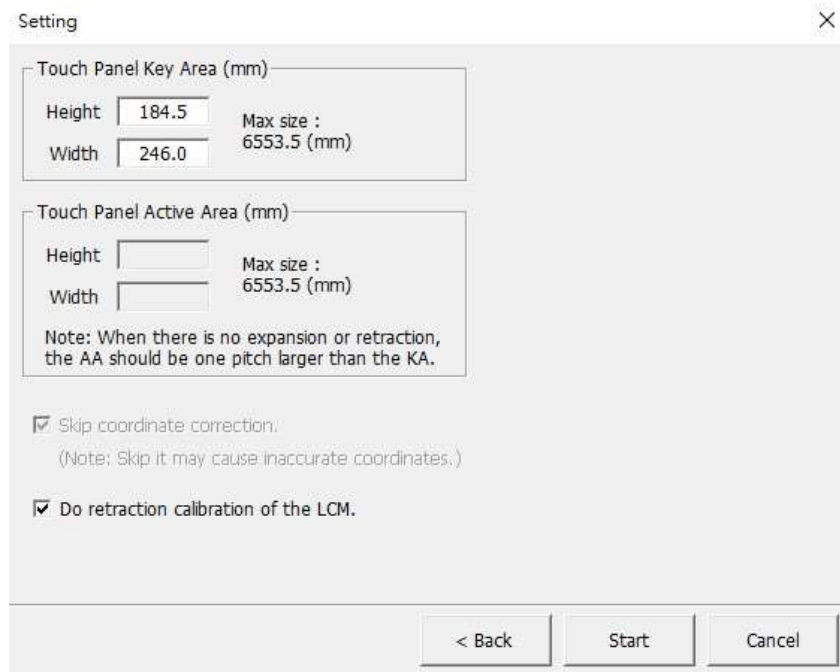
a. Skip coordinate correction

This will disable touch coordinate adjustments on edge. The Active Area settings will be ignored.

FIGURE 98

b. Do retraction calibration of the LCM

If you do not know the exact Active Area settings, please check this option to launch interactive calibration instead of manual input. When this option is checked, only the Key Area setting will be used.

FIGURE 99

- Press Start for detection. Messages appear to notify users to avoid placing hand, dirt, or other objects on touch panel during detection.
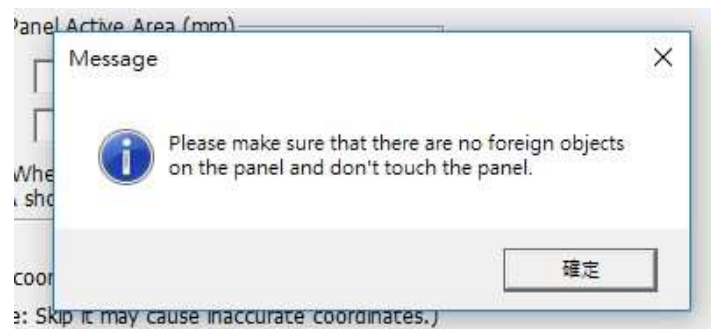
FIGURE 100

• The utility starts full screen data collection, and prompt user not to touch

FIGURE 101

84
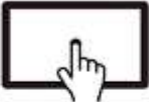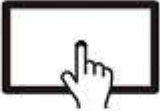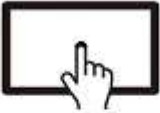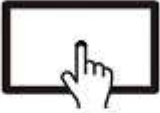
In this phase, the utility will do the following.

- Tune Sensor & Driver Index

- Tune Charge Count Setting

- Tune Driving Wait


- Tune Finger Threshold

In this phase, the utility prompts to press and hold for a few seconds on center and on each corners

respectively.

A	B	C
Touch heavily Please press the center of the panel heavily with your finger, then click the 'OK' button. (Hot Key: Enter) OK	Touch heavily Please keep touching.	Please release touch.
■ Please press the upper left of the panel heavily.	Touch heavily Please keep touching.	Please release touch.

Please press the upper right of the panel heavily.	Touch heavily Please keep touching.	Please release touch.
Please press the bottom right of the panel heavily.	Touch heavily Please keep touching.	Please release touch.
Please press the bottom left of the panel heavily.	Touch heavily Please keep touching.	Please release touch.

10. Tune Tail Orientation

To determine the panel orientation, please follow the instructions on screen to touch and drag from top to bottom.
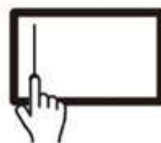
Please draw a line from top left to bottom left.

FIGURE 102

11. Tune Water Parameter

In this phase, utility will prompt user to select the desired water solution.

FIGURE 103

The utility will then ask user to further tune the parameters by drawing or press and hold.

OFF (KBU mode)	Water Detect	Water Performance
Tune KBU Parameter	Tune Water Parameter	
Press and Hold for 90 seconds, then release finger when prompted.	Pour water on touch panel surface, increase level until no false touch caused by water.	

- Tune Coordinate

The final step is to tune coordinates. Depending whether the "Do retraction calibration of the LCM" option is checked, the utility will do calibration of ask user to setup edge parameters manually.

	Calibration	Tune Edge Parameter
Do retraction calibration of the LCM	ON	OFF

- Calibration

In calibration process, the utility will ask user to touch at three points.

A	B	C
Please click red target.	Please click red target.	Check Point Test. Please click red target. (Press F9 to skip test.)

The third point is the check point. If user does not press and hold on it accurately enough, the test will fail. However, user can still choose to use the calibration result.
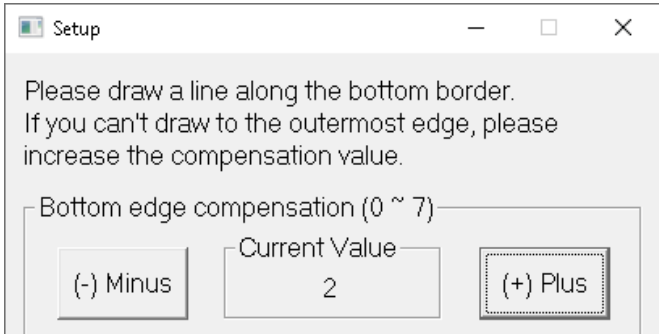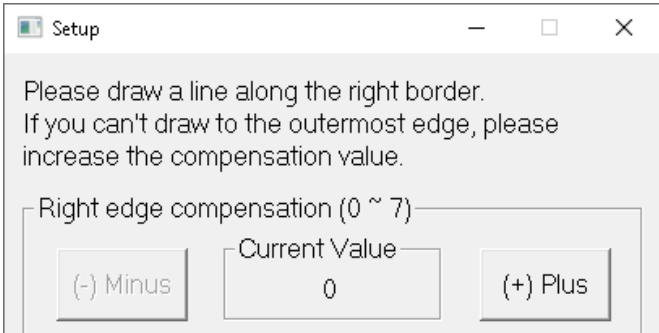
Check Point Test Failed.
Do you want to save
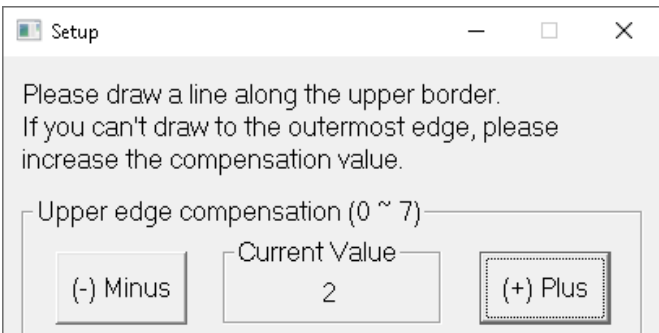calibration data?

Yes   No
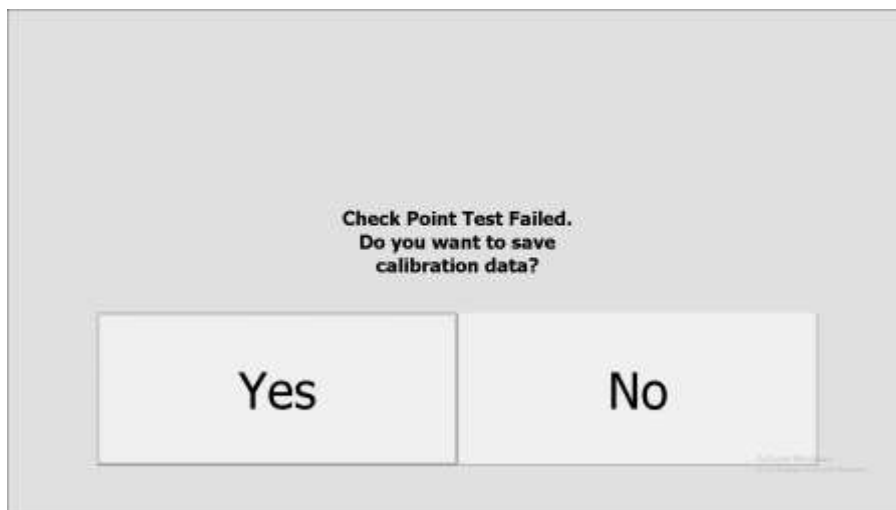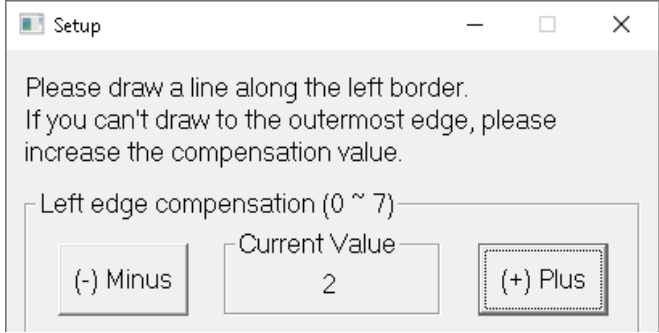
FIGURE 104

● Tune Edge Parameter

The utility will ask user to manually draw on each edge and increase the parameter if the result cannot reach the very end of the edge.

Left Edge	
Bottom Edge	
Right Edge	
Top Edge	

If the "Skip coordinate correction" option is not checked, the utility will also show information of the calculated expansion or extraction offsets of the touch points.
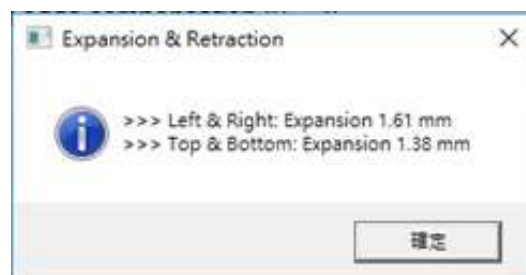
FIGURE 105

7. Debug

The debug panel provides several features for analysis of touch status and debugging touch issues.
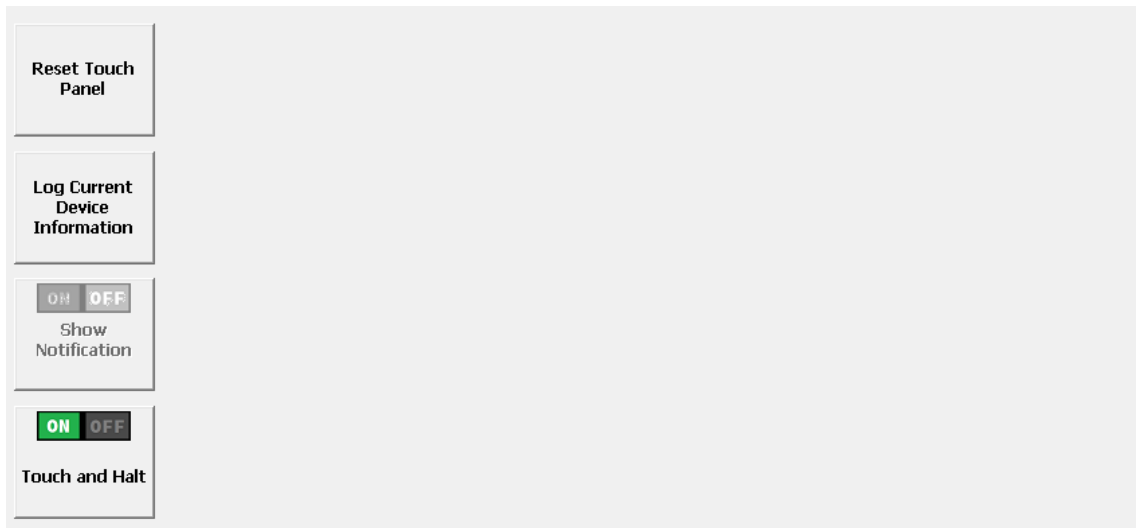
7.1 Reset Touch Panel

Choosing this option will force the PenMount touch device to be reinitialized. There will be a message box asking for user confirmation, please choose "Yes" to perform device reset and wait until the "Reset touch panel finish" message appears.

Reset touch panel may help resolve some touch malfunction issues when panel is affected by environmental changes such as temperature, water, or noise.

7.2 Log Current Device Information

Choosing this option will save firmware information to file which can be provided to the PenMount team for issue debugging. Due to the amount of information, the whole process could take several seconds.

As a practical condition, the human body and the system cannot share the same ground. The touch panel performs normally when it is isolated.   However, the touch panel may be interfered with when a human touched the panel. This is because noise may come from a different ground.

This function can guide the user to obtain information step by step and save this information in the directory that the user specified.

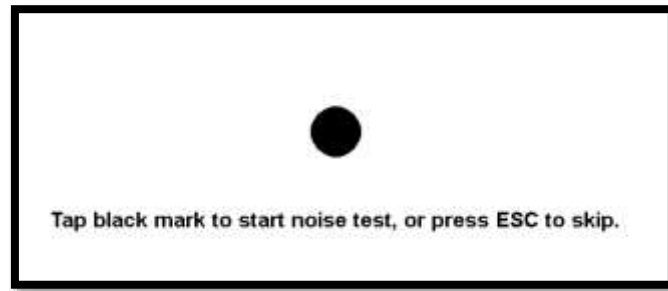When user starts the test, tap the black mark to start noise test.

Tap black mark to start noise test, or press ESC to skip.

FIGURE 108

Then, do not touch panel while the firmware is sampling.

Standard deviation sampling... 39/50
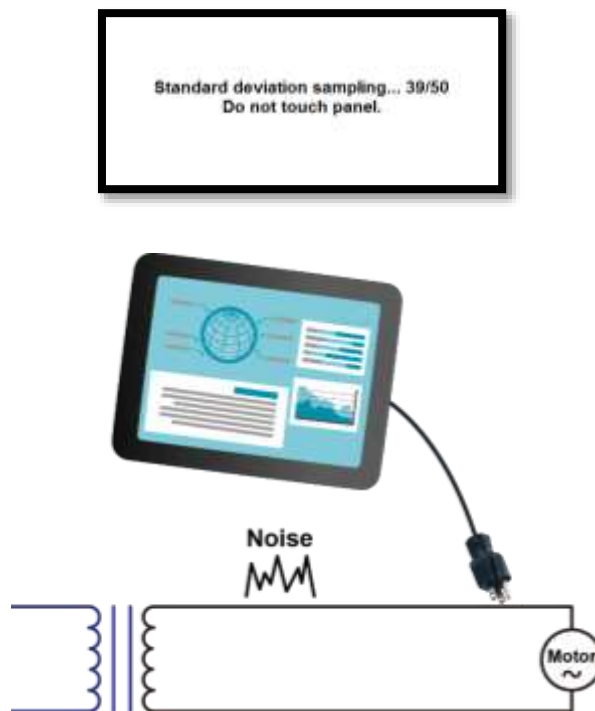Do not touch panel.

Noise

Motor
~

FIGURE 109

When the screen shows the black point, please keep touch it until the process is finished.
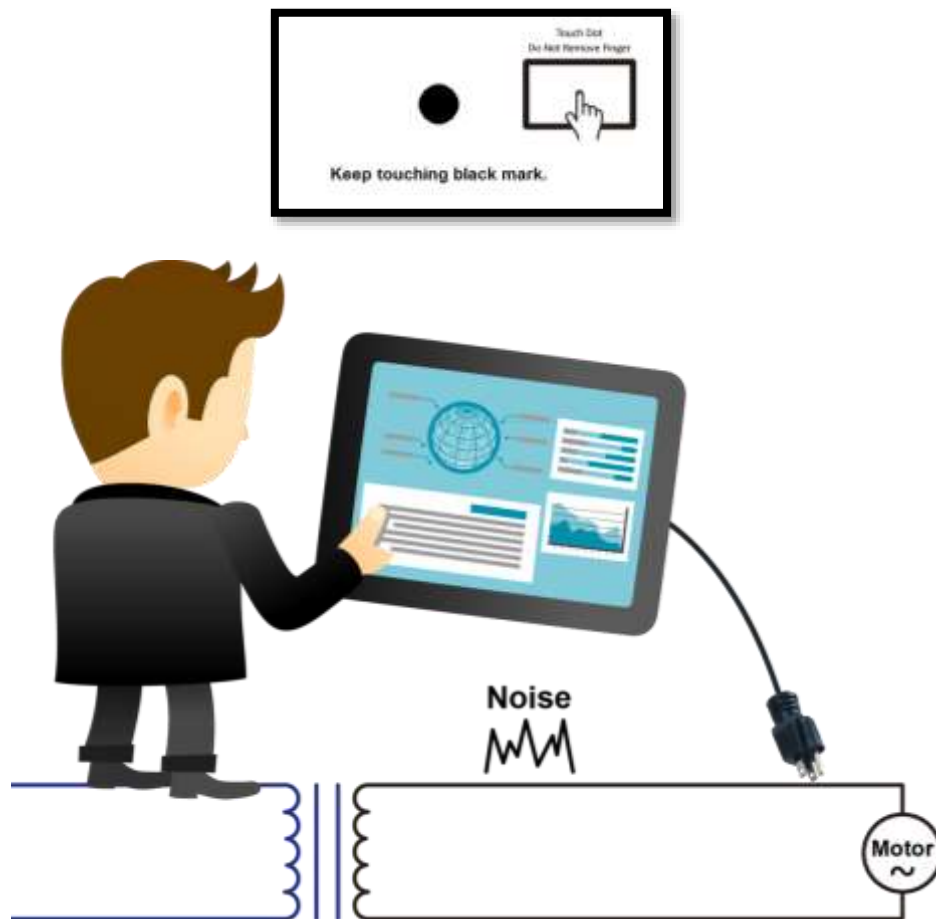

FIGURE 110

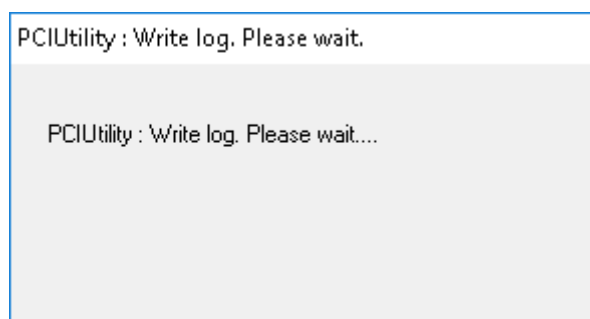Finally, please wait for the "Write log finish" message to appear.

FIGURE 111

The file consists of the useful information for debugging touch issues.

7.3 Show Notifications for Water Detection

When firmware is using "Water Detection" mode, touch will be disabled when firmware detects water on touch panel surface.

Choosing the "Show Notification" option enables more conspicuous notifications when touch is disabled. The warning dialog box will disappear after several seconds.
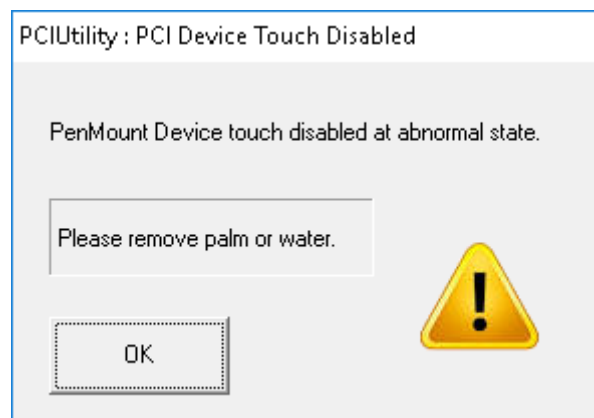

FIGURE 112

7.4 Touch and Halt

The touch and halt feature is supported by the latest PenMount firmware, which is used for debugging touch issues. If this field is grayed-out, it means that the firmware does not support this feature.

When enabling, utility will ask user to choose a folder to store firmware information.
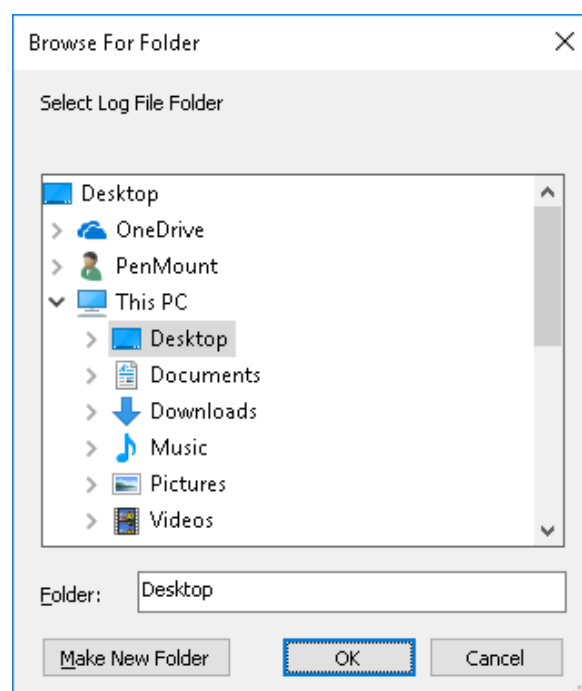
FIGURE 113

After enabling, each touch operation will trigger the firmware to cease scanning and allow the utility to retrieve the most accurate information from device. This feature will be switched back to disabled state after utility finishes saving data.

8. Process Config

"Process Config" is the feature that allows generating process configuration files to be used in PenMount production line utility for processing the configured tasks.

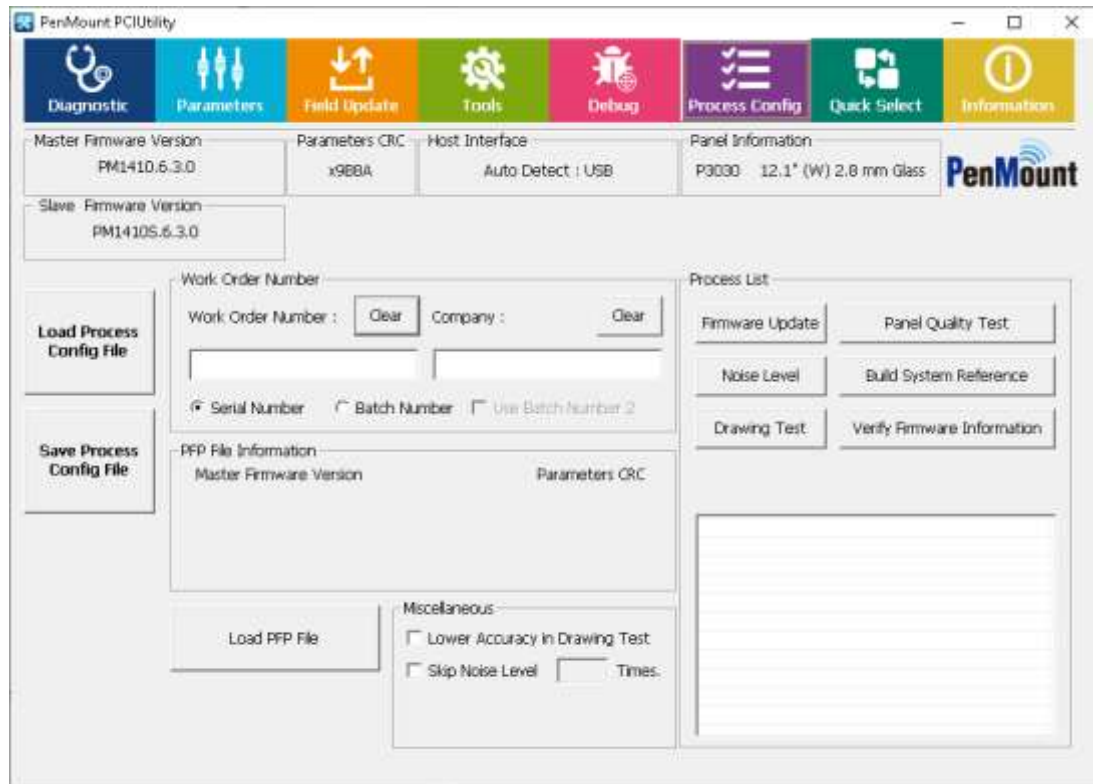This feature is accessible without PenMount device connected.

FIGURE 114

- Load Process Config File

  Log the existed process configuration file to check detail or modify the setting.
- Save Process Config File

  Save the current setting the in the process configuration file.
- Load PFP File

  Load the PFP file to set up the process configuration file

8.1 Work Order Number

A "Process Config" file is a plan text file with INI extension. The following information is necessary to create a new file.

The work order number is defined by project or by company.

FIGURE 115

Choose the "Batch Number" or "Use Batch Number 2" option when output file is for batch test.

Choose the "Serial Number" option when output file is for individual test.

8.2   Load PFP File

Please provide a valid PFP file by using the "Load PFP File" button. After that, the information of the file will be displayed in utility.

FIGURE 116

8.3   Miscellaneous

Several options are available for tweaking the test flow.

- Lower Accuracy in Drawing Test

User can select drawing test to check if the PCAP can be draw smoothly. However, sometimes the user test without LCM and the accuracy may be affected. The user can switch on "Lower Accuracy Test in Drawing Test" to improve the production line efficiency.

The next two figures show the normal test area for drawing test, and the test area when the user can switch on "Lower Accuracy Test in Drawing Test".
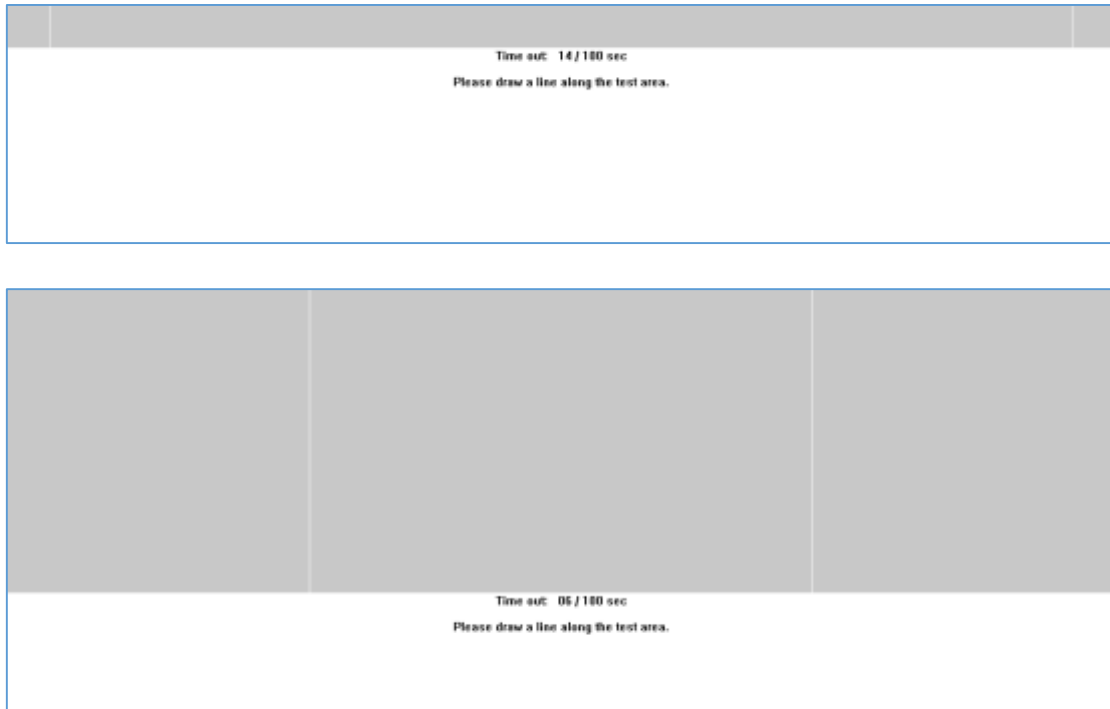
Time out: 14 / 180 sec

Please draw a line along the test area.

Time out: 06 / 180 sec

Please draw a line along the test area.

- Skip Noise Level N Times

Noise Level Test costs a lot of time. When performing batch tests for multiple control boards, it is not always necessary to do noise level test each run. In this case, user can specify the skip times in this field.

For example, if set up "Skip Noise Level 2 Times", the test flow may become as below.

Test #	1	2	3	4	5	6	7
Do Noise Test	YES	SKIP	SKIP	YES	SKIP	SKIP	YES

8.4   Select Tests for Process List

Each button under the Process List group is represents a specific task. Please click on the desired button to add the task to Process List. To remove it, please click the button again.
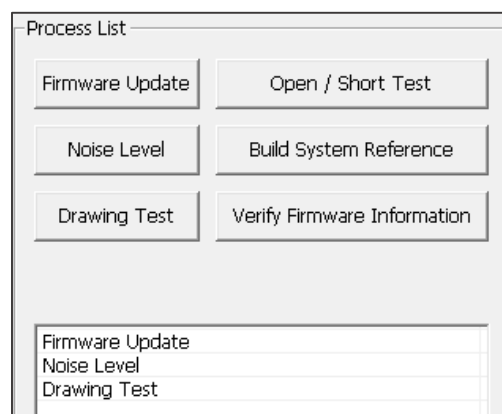
FIGURE 118

The process order is determined by the task selection sequence. In the example above, the selection order is "Firmware Update", "Build System Reference", and "Drawing Test", and the PenMount production line utility will also follow this order to perform tasks.

Task	Description	Option
Firmware Update	Update firmware with the selected PFP file.	
Open / Short Test	Do open short test	
Noise Level	Do noise level test with pattern "WHITE", "BLACK", and "CHECKERBOARD"	
Build System Reference	Build system reference	
Drawing Test	Do instructed draw test to verify touch functionality and within acceptable accuracy.	Low Accuracy in Draw Test When this option is selected, "Draw Test" will allow much relaxed passing conditions.
Verify Firmware Information	To verify if the device firmware matches the selected PFP file.	