PENMOUNT P2 PCIUTILITY

USERS' GUIDE

FOR MICROSOFT WINDOWS

Version 2.0B

2024/02/29

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 3.4 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 3.4.3 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) 3.4.3: 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: 3.4.3 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: 3.1 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: 3.4, 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: 3.4.2, Add options for changing background color.
		(3)	Add: 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: 3.1 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.
12/Aug/2022	1.11.1	(1)	Add: 3.4.2.1 threshold adjustment when testing touch panels without shielding design.
05/Feb/2024	2.0	(1)	Supported Device List Revised
		(2)	Modify: Quick Select feature is revised.
		(3)	Add: 4.9.4, Thick Front Bezel Configuration.
16/Feb/2024	2.0A	(1)	Modify 3.2: Descriptions of the noise level test result.
29/Feb/2024	2.0B	(1)	Modify 2: GUI adjustment.

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 / 2022
Embedded	Windows XP Embedded / Standard 2009
	Windows Embedded Standard / POSReady 7
	Windows Embedded 8 Standard / Industry
	Windows 10 / 11 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		
	PM2207	v		v
	PM2303	v	v	v
	PM2304	v	v	v
	PM2356	v	v	
	PM2357	v		
	PM2358	v	v	v

The "Quick Select" feature supports the following firmware versions.

Touch Panel Model	Size	Control Board	1.1mm	1.8mm	2.8mm	4.0mm
AMT P3007	8.4"	PM1310 V6.4 V6.5	v	v	v	v
AMT P3008	10.4"		v	v	v	v
AMT P3021	10.1"		v	v	v	v
AMT P3023	15.6"	PM1410 PM1415 V6.4 V6.5		v	v	v
AMT P3026	12.1"		v	v	v	v
AMT P3029	15"			v	v	v
AMT P3030	12.1"		v	v	v	v
AMT P3019	18.5"	PM1710 PM1711 PM1715 V6.4 V6.5		v	v	v
AMT P3022	21.5"			v	v	v
AMT P3027	19"			v	v	v
AMT P3028	17"			v	v	v
AMT P3034	23.8"			v	v	v

1.3   File Summary

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

1.3.1   Main Files

Utility	Usage	Application Version	Notes

Utility	Usage	Application Version	Notes
PCIUtility.exe	Advanced firmware configuration	2.0.X	x86 32-bit Windows application.
PM_Standard.dll	Companion library of PCIUtility.	1.7.X	
PCIUtility.ini	Default settings of PCIUtility.		

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

1.3.2 Optional Addon Files

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

1.4 Checking Utility Information

The version of PCIUtility and other useful information are listed on the "Information" page.
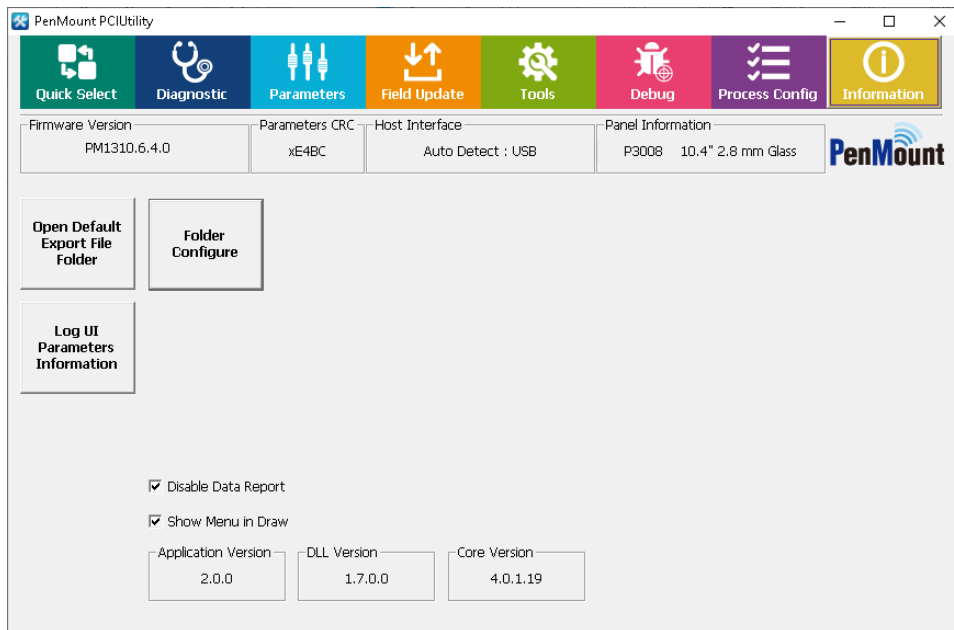
FIGURE 1

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.
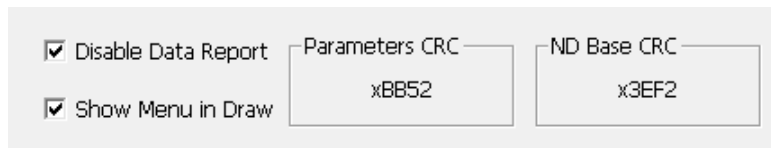

FIGURE 2

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:
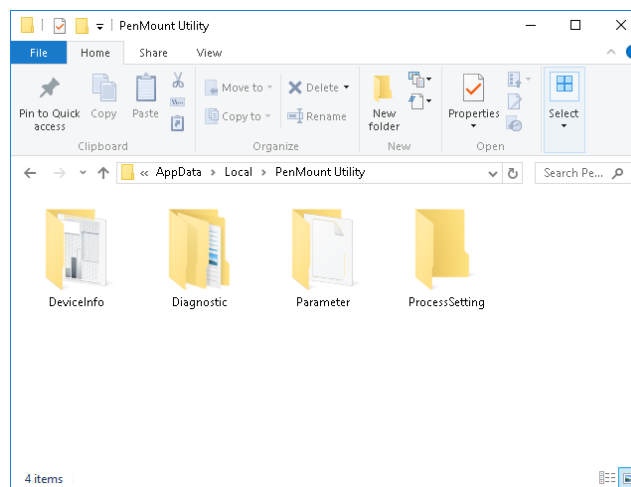
%LOCALAPPDATA%\PenMount Utility

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.

	A	B	C	D	E
1	Log Time:	2024	1-Oct	13:09:30	
2	Function:	Log UI Parameters Information			
3					
4	[SW Info]				
5	Version	Application	PenMount PCIUtility 2.0.0.0		
6	Version	Library:	1.7.0.0		
7					
8	Master Version : PM1310.6.4.0 Boot : 8.0				
9					
10	Core Version : 4.0.1.19				
11					
12	Device Interface : Auto Detect : USB				
13					
14	Parameters CRC : x8C86				
15					
16	Host Interface : Auto Detect :USB				
17	I2C Address : 0x38				
18	Baud Rate : 38400				
19	Hid Report : Digitizer Mode (PID 3508)				

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
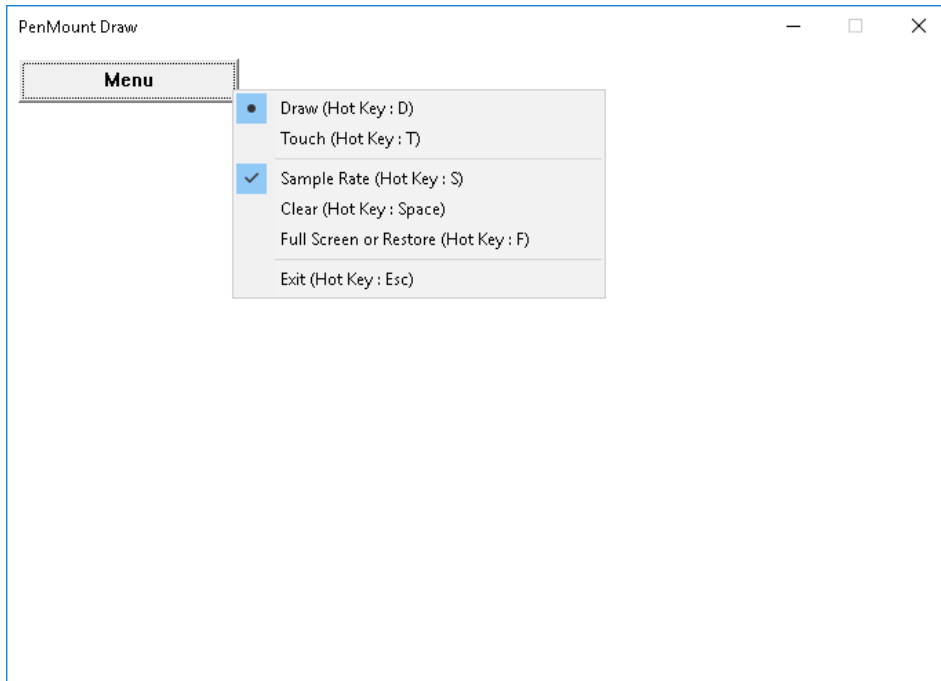
option in menu.

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.
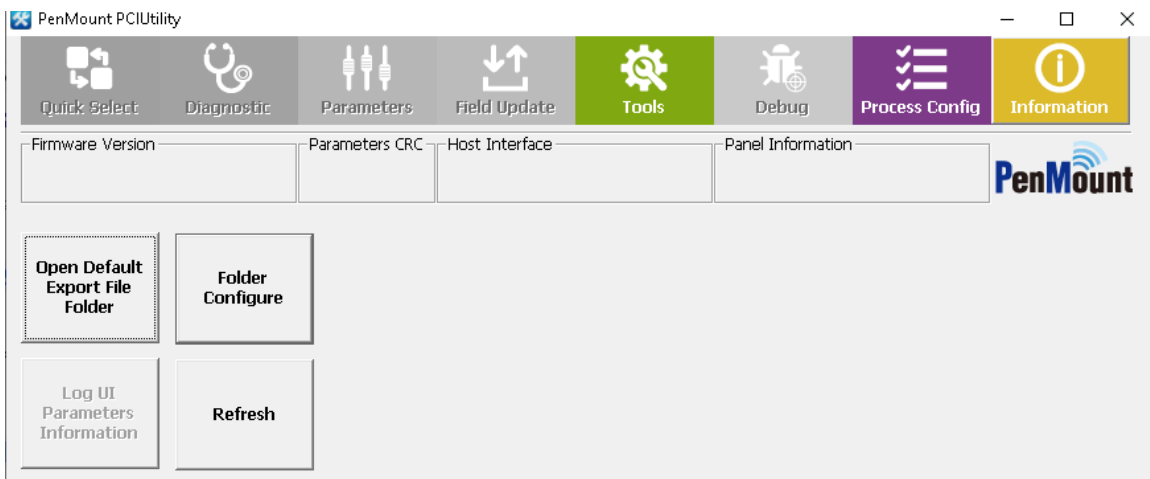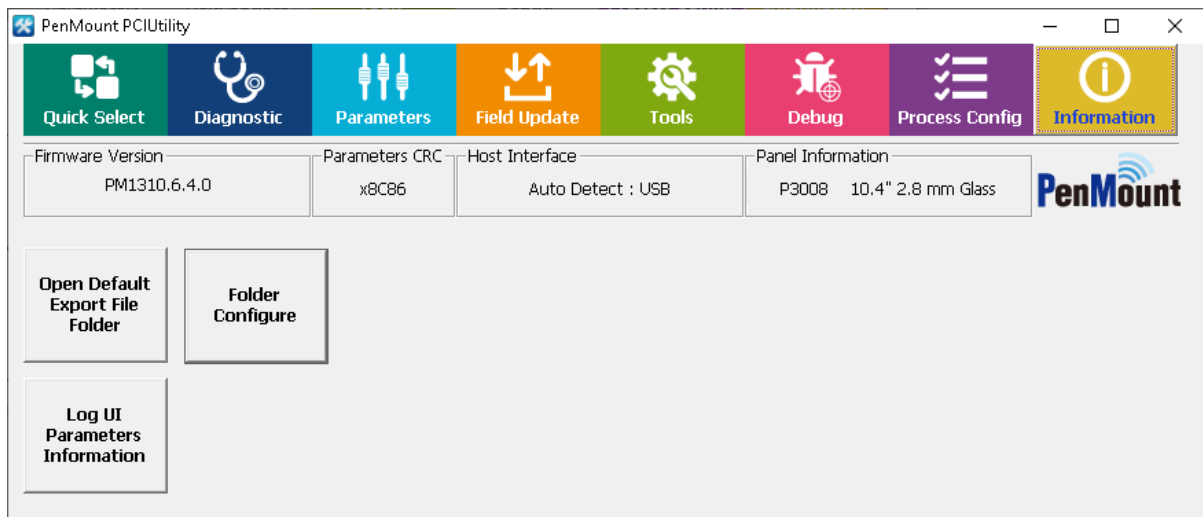
FIGURE 6

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 3.1
-nl0	Noise Level Test, using pattern "NONE"	Section 3.2
-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 3.4
-srns	Build System Reference (no dialog box for log saving)	Section 3.4
-psave	Saves parameters of the connected device to INI file.	Section 4
-pload	Loads parameters from specified INI file to connected device	Section 4
-fu	Load specified firmware file and perform firmware update.	Section 5

2. Quick Mode Selection

This feature provides a convenient way to switch between modes for *anti-noise performance optimization*.
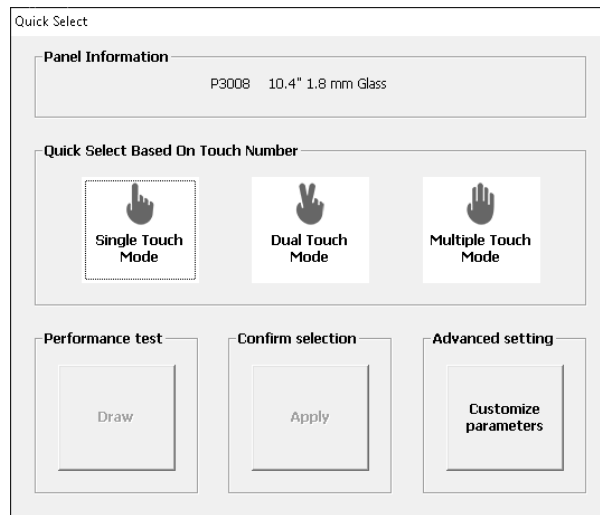

FIGURE 7

FIGURE 7

STEP 1. Check Panel Information

The utility will show the firmware panel configurations on top of the window. Please check if the information is correct.
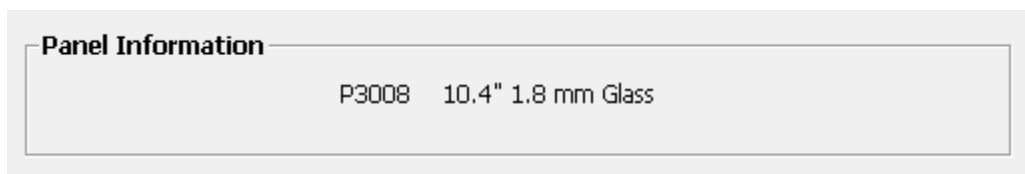

Figure 8

If the firmware configuration does not match the panel or cover lens physically used, or after firmware update, please use the "Customized parameters" button to return to the main menu of the utility and change the configurations to correct settings.

STEP 2. Select Finger Mode

Select from Single Touch / Dual Touch / Multiple Touch Mode based on your need. For more demanding operating environments, it is recommended to choose a mode with fewer fingers.
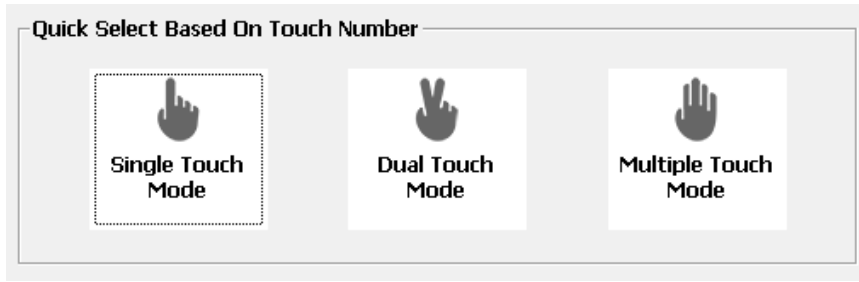
FIGURE 9

The supported modes:

Mode	Sample Rate	Anti-Noise	Gesture Support	Water Handling
Single Touch mode	Good	Extreme	1	Fewer false reports
Dual Touch Mode	Normal	Extreme	1 / 2	
Multiple Touch Mode	Normal	Enhanced	1 / 2 / multiple	

After a mode is selected, proceed by selecting Yes for mode change confirmation. **Please notice that this will overwrite the current device parameters.**
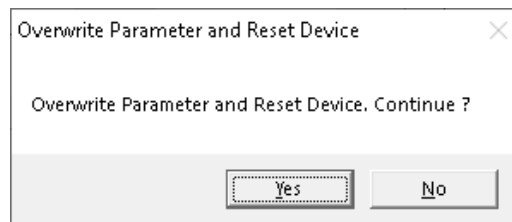

FIGURE 10

STEP 3. Test Performance

The final step is to use "Draw" to test performance.

● Choose "Apply" to continue using this mode and return to the utility's main interface.

● Choose "Restore parameters" to restore to original device settings and return to the utility's main interface.
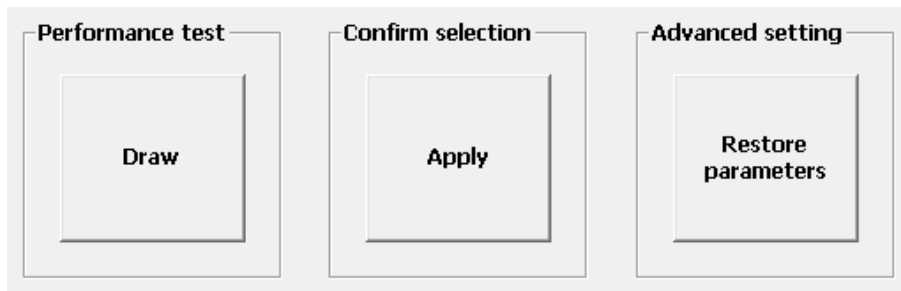
FIGURE 11

3. 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.
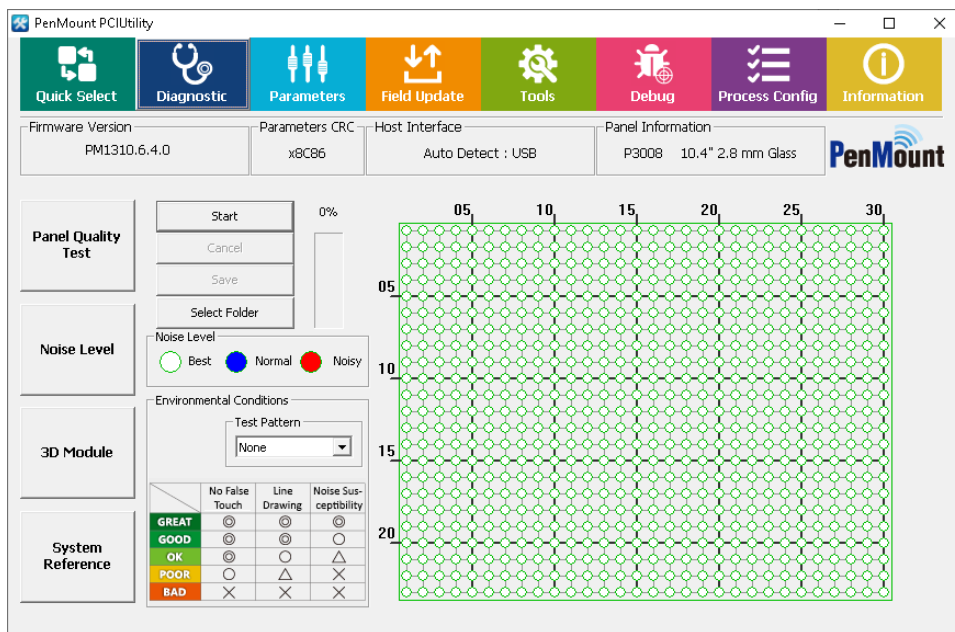

FIGURE 12

3.1 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 13

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.
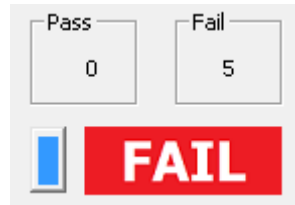

FIGURE 14

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.
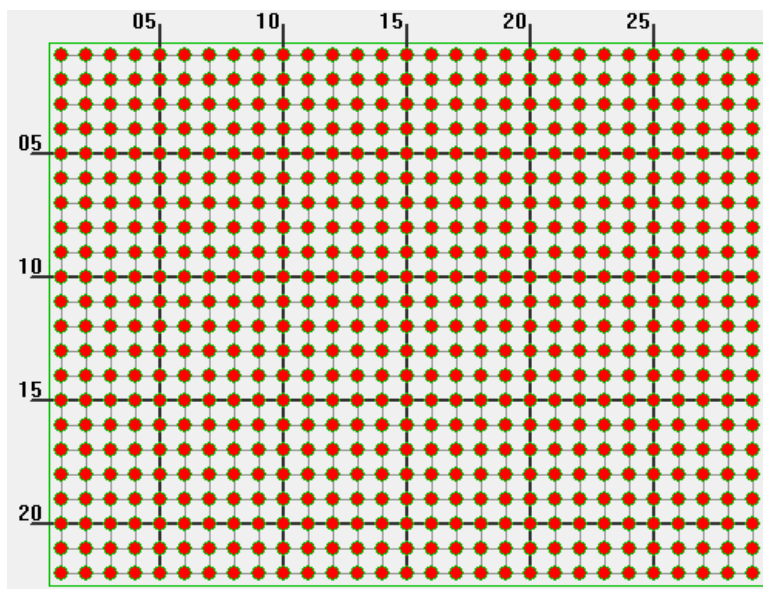

FIGURE 15

3.1.1   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	Data Set	Settings	Threshold
Check the Same Data	PD Data	---	Check if all sets of PD data are identical.

Check Debounce	PD Data	[PCIScan Threshold] Debounce	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.
Check Driver Abnormal	PD Data	[PCIScan Threshold] Driver Driver Percent	Test the raw data of two consecutive driving and the difference between them should not be excessively large.
Check Sensor Abnormal	PD Data	[PCIScan Threshold] Sensor Sensor Percent	Test the raw data of two consecutive sensor pins and the differences should not excessive.
Check Absolute Data	PD Data	[PCIScan Threshold] Absolute	Checks whether raw data is within valid range.
Check ND Base	ND Base	[PCIScan Threshold] Do_ND_Base_Check	Check if ND base normal.
Check Near Raw	Raw Data 1	[PCIScan Threshold] Skip_Do_SR_Test	Checks whether the raw data of two adjacent driver lines/sensor lines is similar.
Check Base Flat	Mode Diff	Enabled by GUI option	Checks whether the base is flat.

3.1.2 Test Result & Analysis

When diagnose ends, the program displays messages for each failed test items:
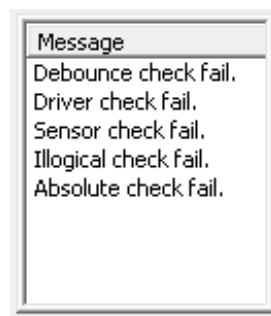
FIGURE 16

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.
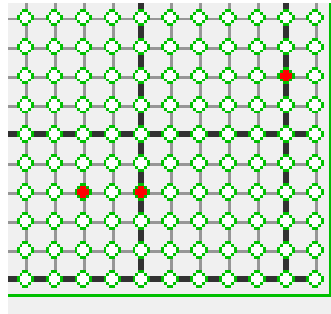

FIGURE 17

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.
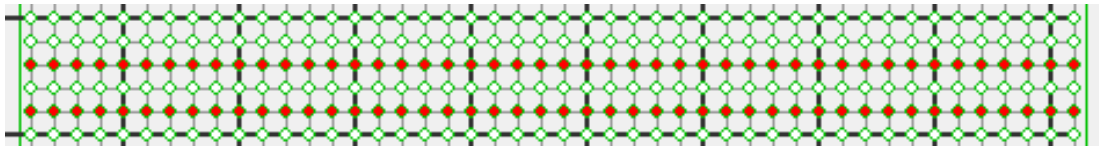

FIGURE 18

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.

3.1.3   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.
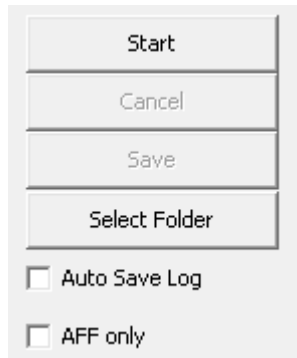
FIGURE 19

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.

3.1.4 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.

1			
2	[SW Info]		
3			
4	Log Info Spec Version:	V 3.0.1	
5			
6	Log Time:	10/1/2024 13:18	
7	Version	Application:	PenMount PCIUtility 2.0.0.0
8	Version	Library:	1.7.0.0
9	Function:	Panel Quality Test	
10			
11	[FW Info]		
12	Version	Firmware:	PM1310.6.4.0 Boot : 8.0
13	Version	Core:	V4.0.1.19
14	Panel Information:	P3008 10.4"	
15	Cover Lens:	2.8 mm Glass	
16			
17	[Parameter]		
18	Parameter	CRC:	x8C86
19			
20	Batch1:	P3008	
21			
22	Batch2:		
23			
24	[Panel Quality]		
25	Result:	FAIL	

FIGURE 20

- 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 21

28

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.
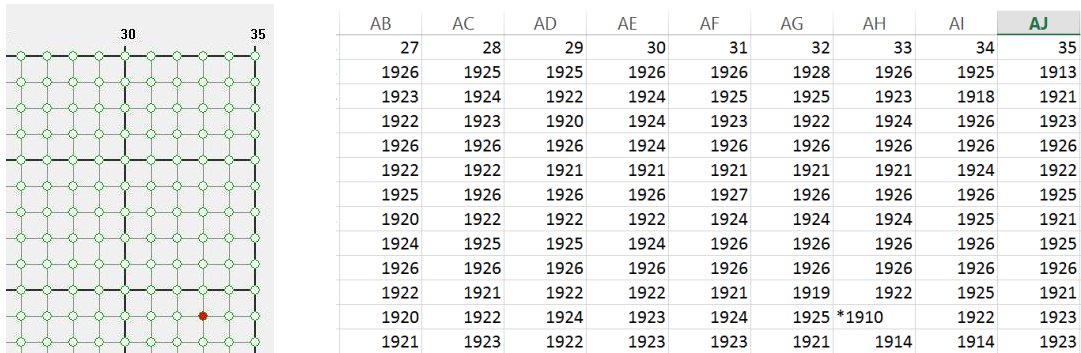

AB	AC	AD	AE	AF	AG	AH	AI	AJ
27	28	29	30	31	32	33	34	35
1926	1925	1925	1926	1926	1928	1926	1925	1913
1923	1924	1922	1924	1925	1925	1923	1918	1921
1922	1923	1920	1924	1923	1922	1924	1926	1923
1926	1926	1926	1924	1926	1926	1926	1926	1926
1922	1922	1921	1921	1921	1921	1921	1924	1922
1925	1926	1926	1926	1927	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 22

- 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.

3.2 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:
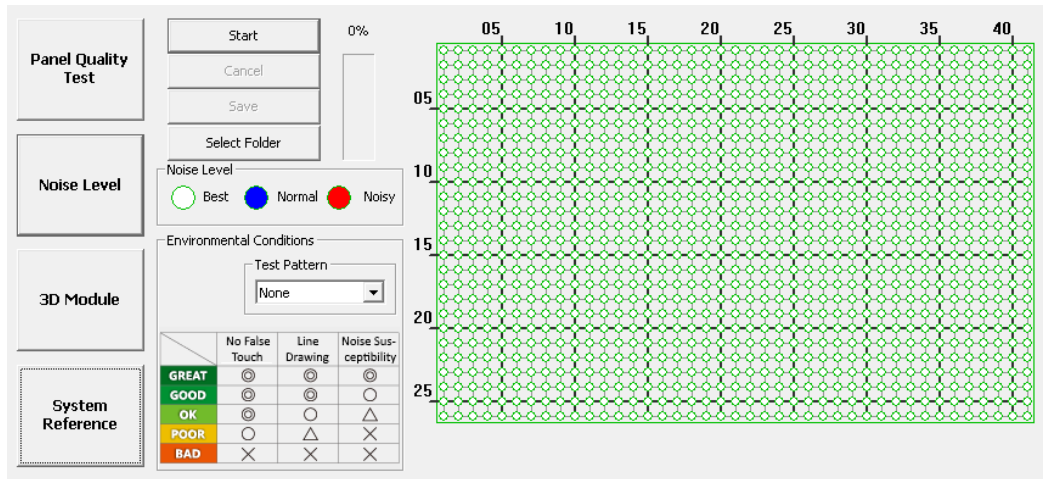
FIGURE 23

3.2.1 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, 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.
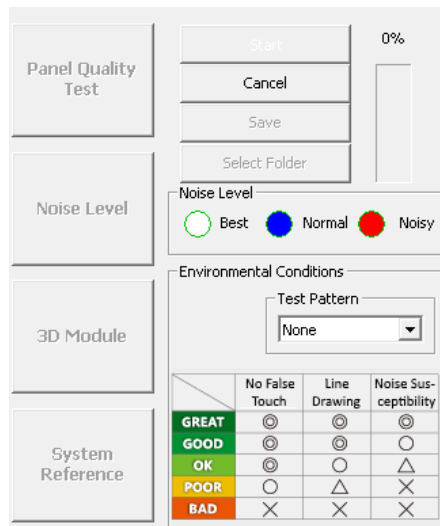

FIGURE 24

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. The utility will obtain 50 instances of raw data for each node and use these raw data to calculate standard deviation for each node.
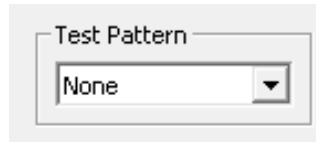
FIGURE 25

3.2.2 Test Analysis

The utility uses standard deviation (SD) and difference threshold values to judge the noise level. 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.
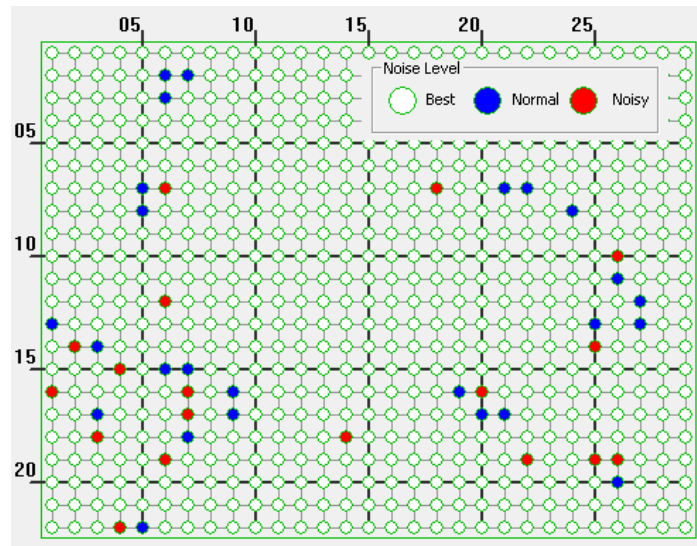
FIGURE 26

Node	Color	Criteria
Best	White	$|SD| \leq \dfrac{1}{6} \ threshold$
Normal	Blue	$\dfrac{1}{6} \ threshold \leq |SD| \leq \dfrac{1}{4} \ threshold$
Noisy	Red	$|SD| \geq \dfrac{1}{4} \ threshold$

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".
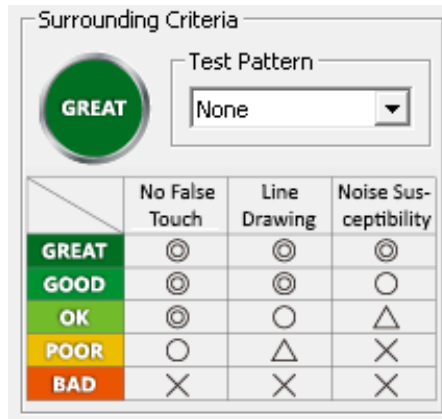
FIGURE 27

The following table shows how the environmental condition is evaluated. The threshold values can be adjusted in the config file.

Result	Node Conditions	Threshold Setting
	Best 100%	[Noise Level Threshold] Great=100
	Best $\geq$ 95% Normal $\leq$ 5% Noisy = 0%	[Noise Level Threshold] Good=95
	Best $\geq$ 85% or Noisy < 1%	[Noise Level Threshold] OK=85 OKRed=1
	Best $\geq$ 50% or 1% $\leq$ Noisy $\leq$ 10%	[Noise Level Threshold] Poor=50 OKRed=1 PoorRed=10
	Best < 50% or Noisy > 10%	

Please try to lower noise interference by increasing the air gap between touch panel and LCD, and also use common ground by connecting the LCD metal frame and the screw holes of the PenMount control board together to bring environmental conditions to a least "OK" level.

3.3 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.
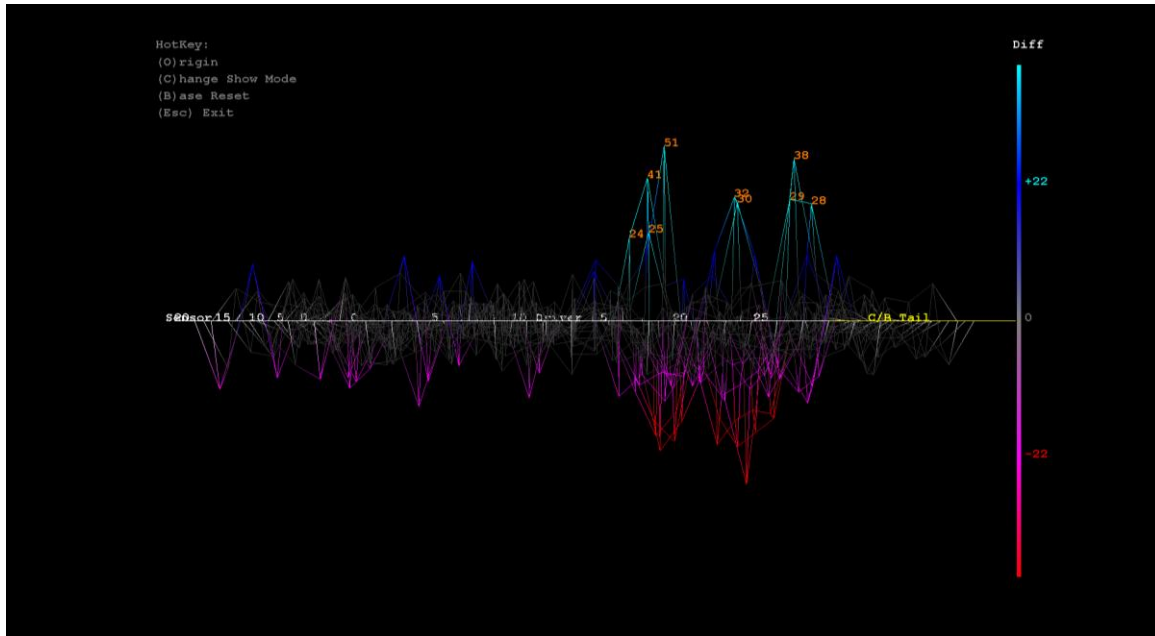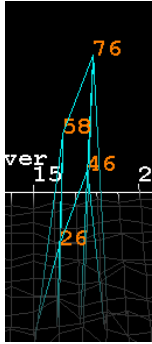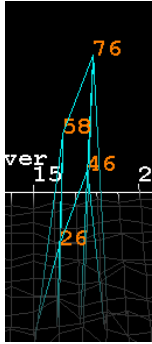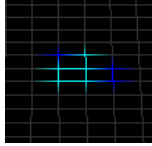
FIGURE 28

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

Colors	Signals
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	

3.4 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.
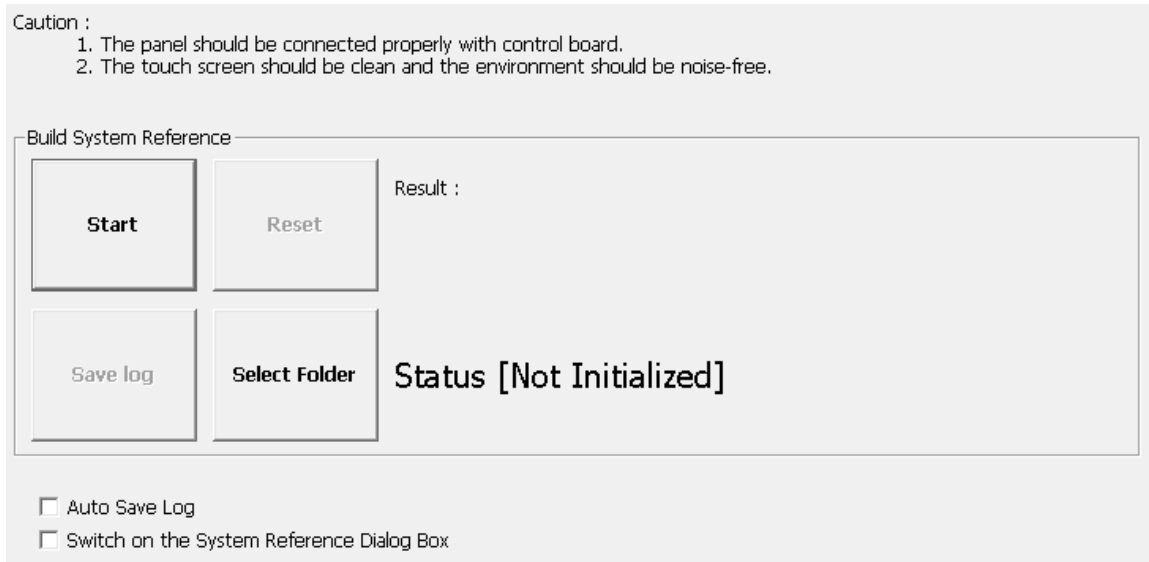

FIGURE 29

3.4.1 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.

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3.4.2 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%.
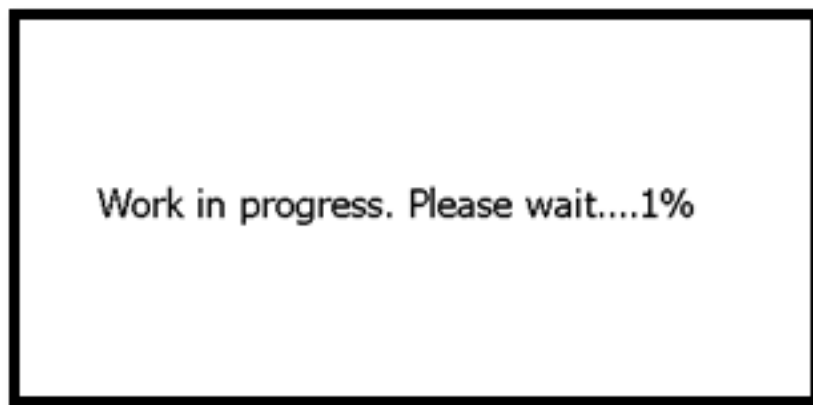

Work in progress. Please wait....1%

FIGURE 30

If the touch panel is not connected properly, or having environmental interference, 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.

Environmental interference. Build anyway ?

Yes	No

FIGURE 32

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

3.4.2.1 Testing No-Shielding Panels

Touch panels without shielding should use loosen threshold values during tests. Please setup proper values in the following settings in PCIMSet.ini file.

Section	Setting	Value
[Build System Reference]	No Shielding	The threshold values in percentage. For example, 120 meaning the normal threshold value * 120% as the new threshold for checking.

3.4.3 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

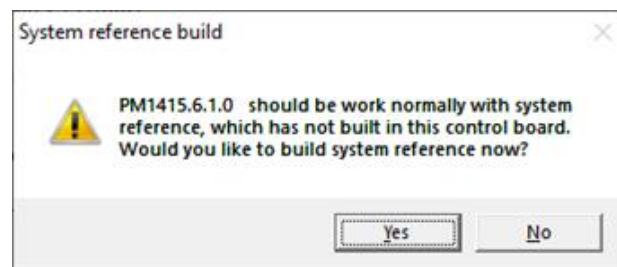When this option is checked, the PCIUtility will notify user for SR construction when it detects that SR is not initialized.

FIGURE 33

4. Parameters

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

FIGURE 34

- The "Apply" Button

    Applied all the parameter changes. A confirmation dialog box will appear.
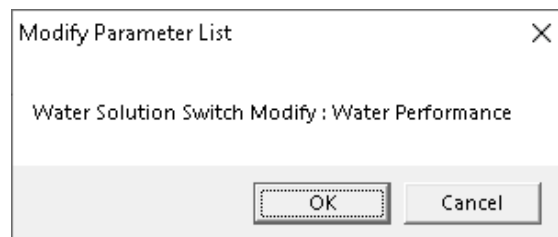

FIGURE 35

    This dialog box will also appear when closing the utility without applying the parameter changes first.

- 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.
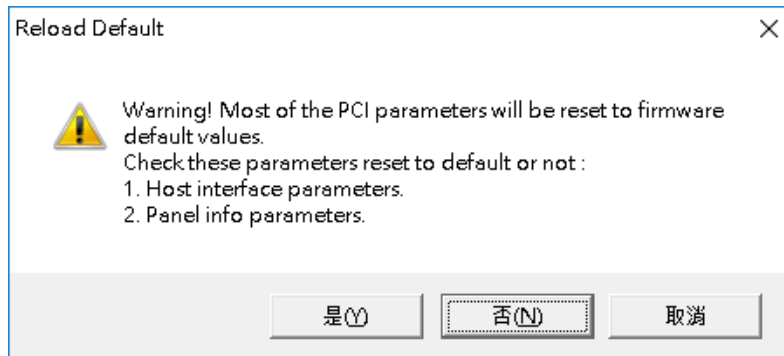

FIGURE 36

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.
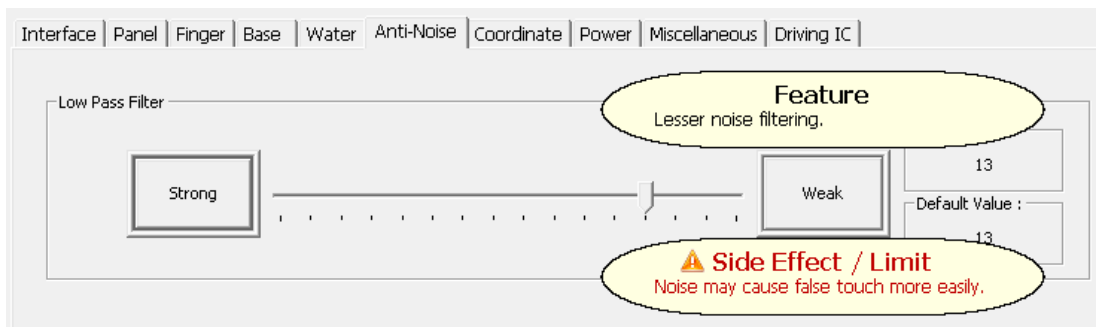

FIGURE 37

- 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.
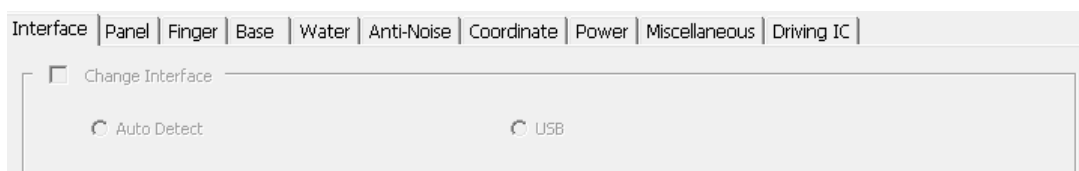
FIGURE 38

- 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.
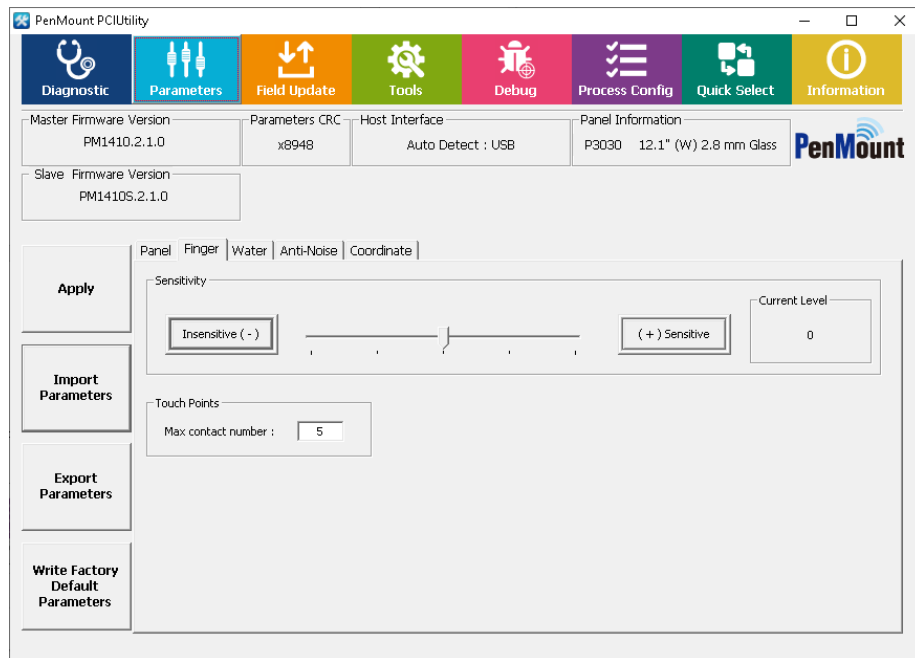

FIGURE 39

4.2   Interface Parameters

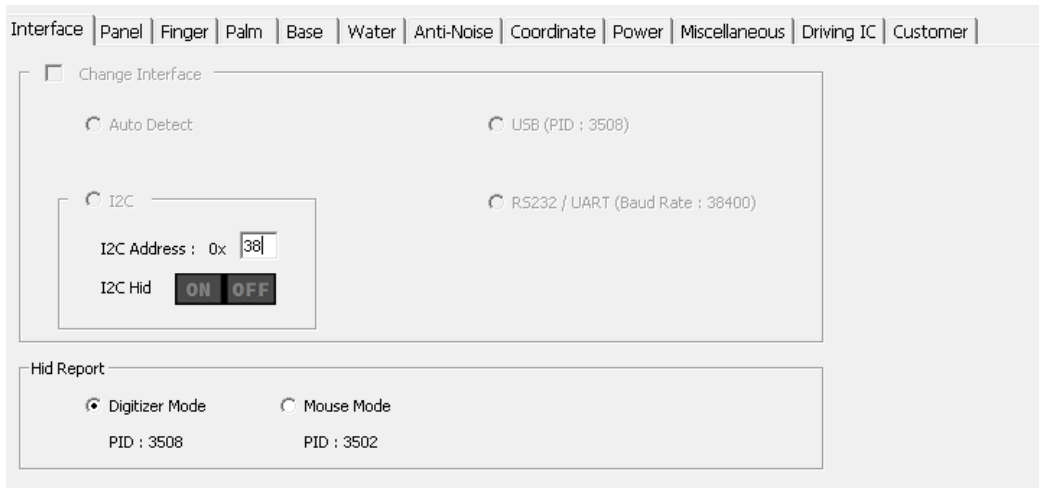Users can change interface settings in the "Interface" tab.

FIGURE 40

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^2C 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.
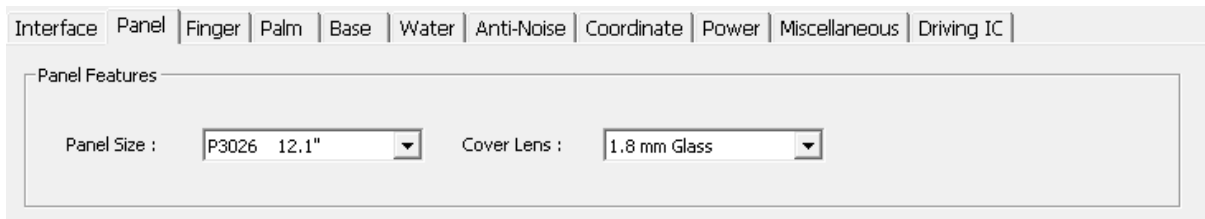

FIGURE 41

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.
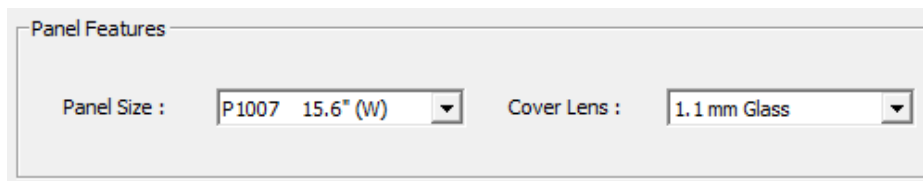

FIGURE 42

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

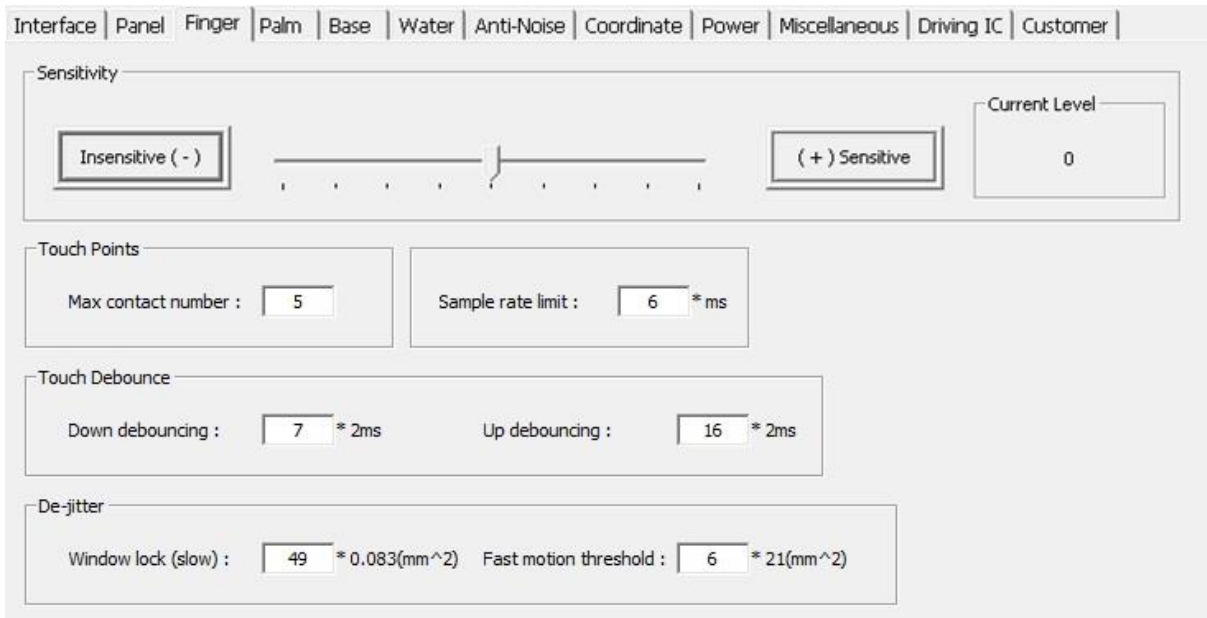The parameters in this tab are for tuning finger detection.

FIGURE 43

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.

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.
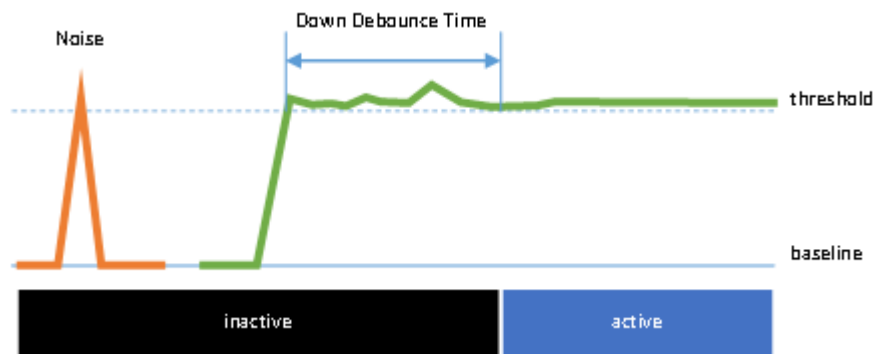

FIGURE 44

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.
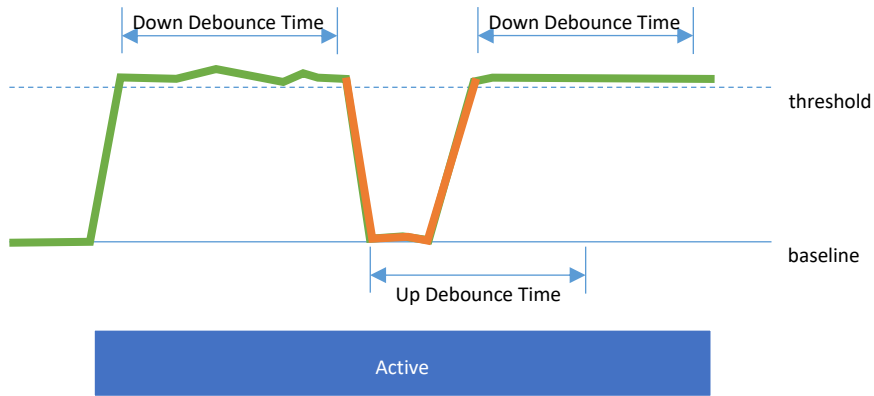
<div align="center">**FIGURE 45**</div>

4.4.5 De-jittering

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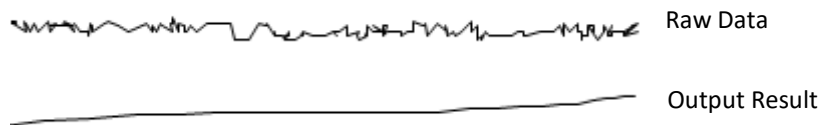

Raw Data

Output Result

<div align="center">**Figure 46**</div>

The "Window Lock" parameters are adjustable to control output smoothness.

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].

---

[3] The "pitch resolution" can be 16 for PenMount PM171x controller, and 32 for other P2-06 or P2-08 devices.
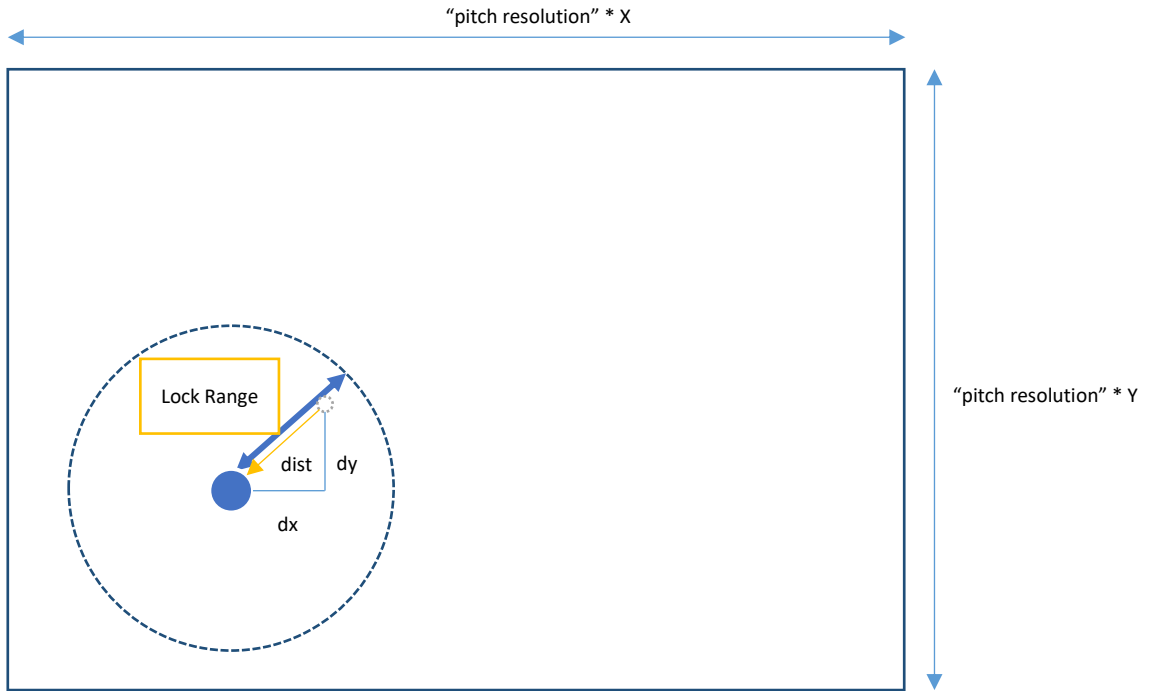
FIGURE 47

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) <= Fast Motion Threshold	10
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".

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The parameter value is calculated as below:

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

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.
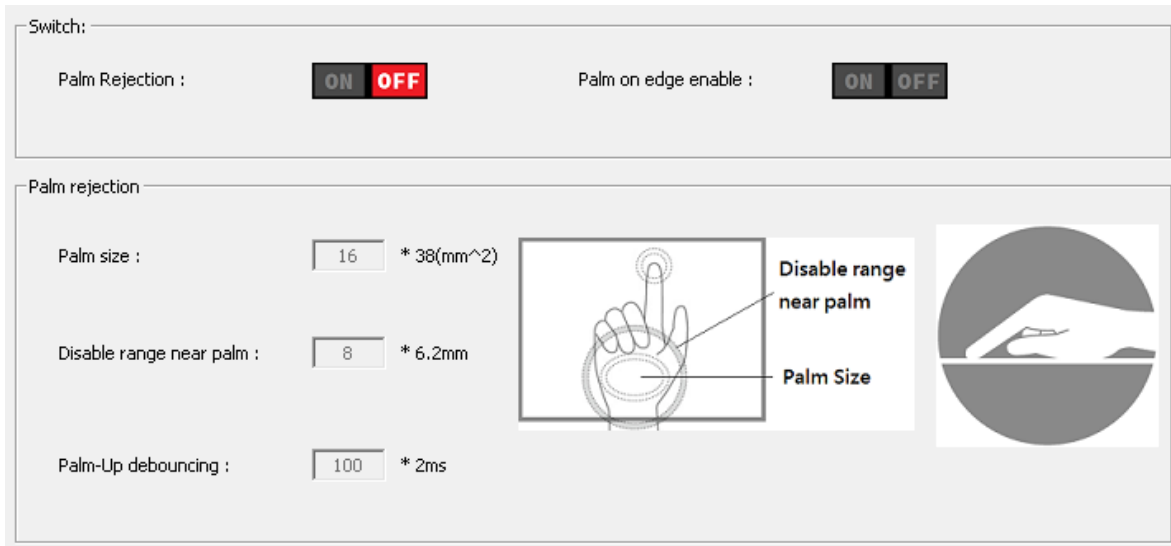
FIGURE 48

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.

4.5.2 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.

---

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

-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 49

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 50

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.
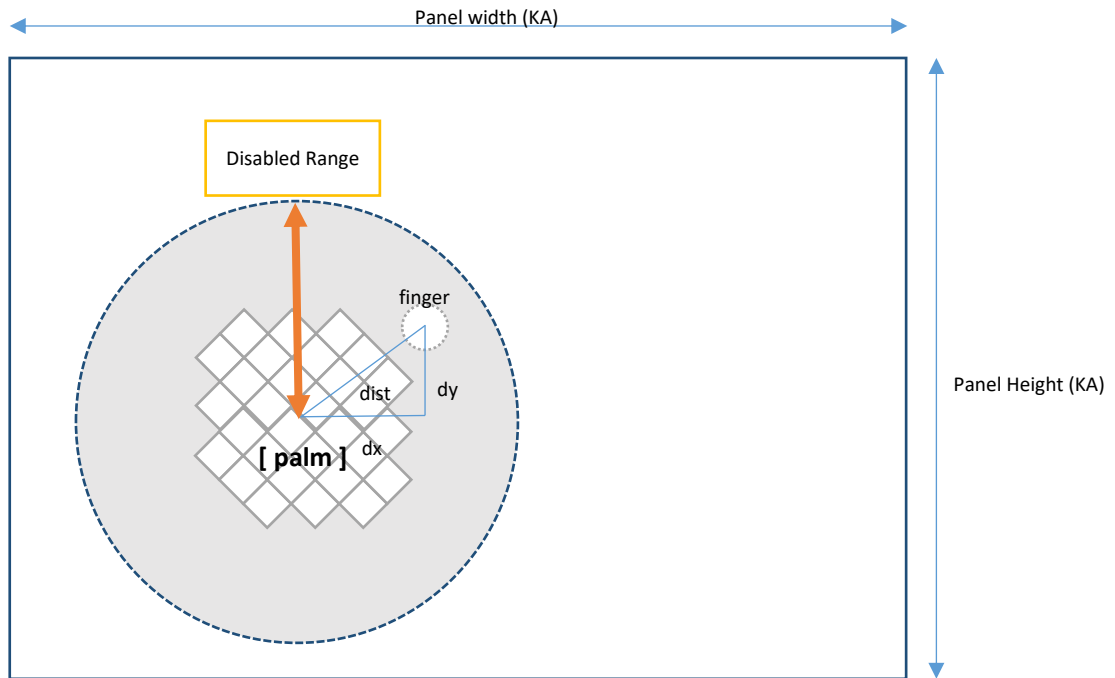
Panel width (KA)

Disabled Range

finger

dist   dy

[palm]   dx

Panel Height (KA)

FIGURE 51

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 52

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.
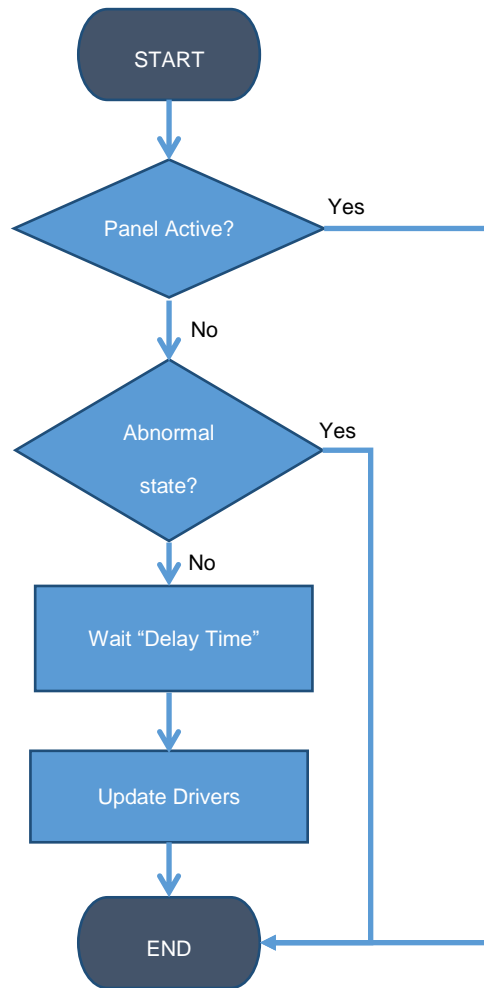
FIGURE 53

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.

Update Driver Pins = 3
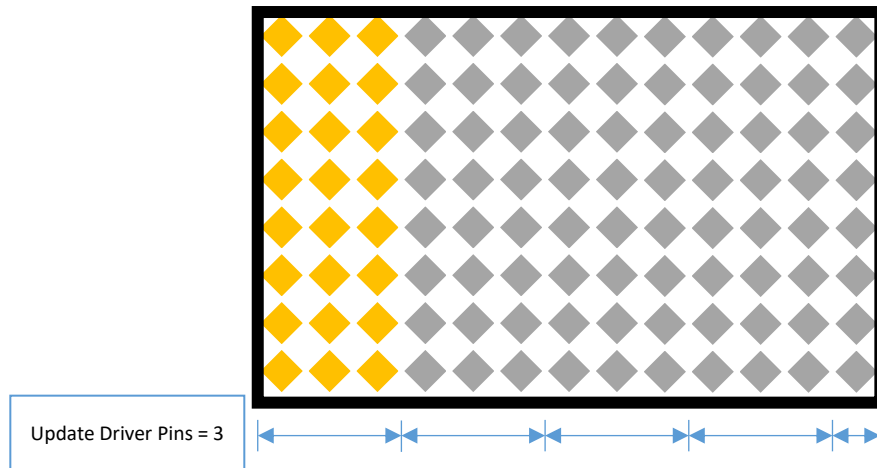
FIGURE 54

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.
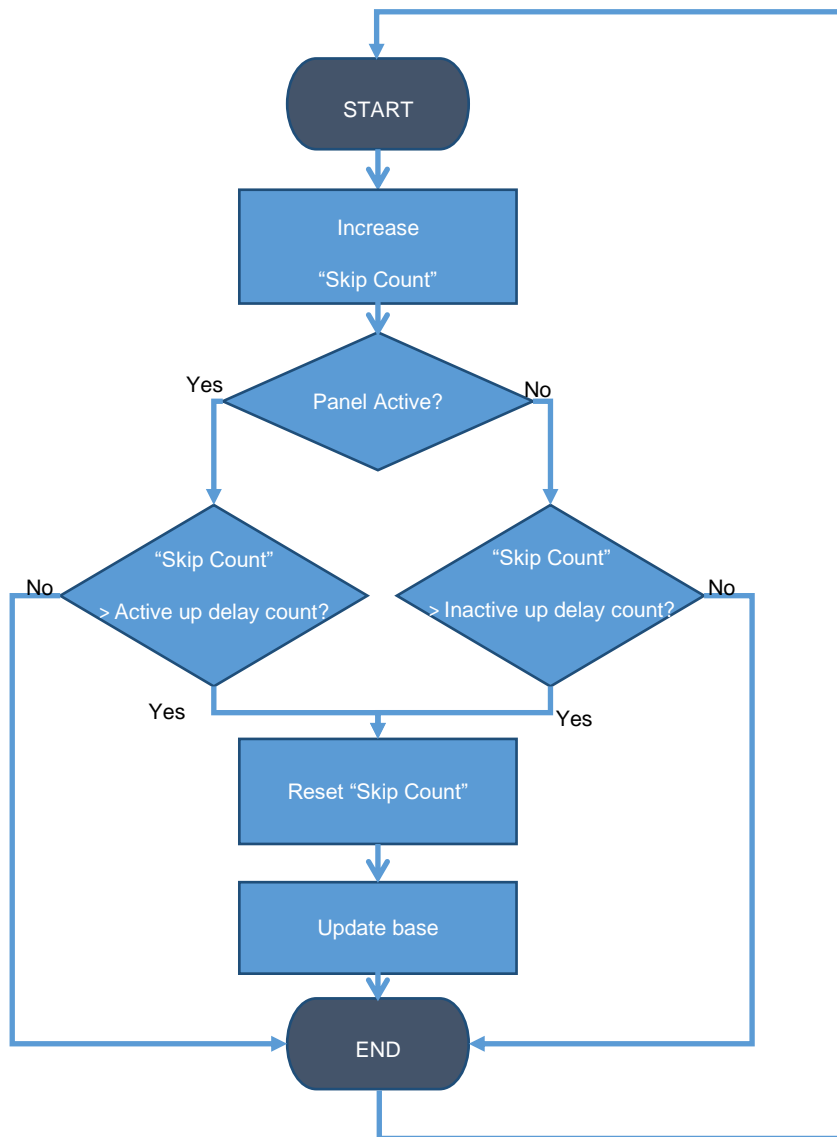
FIGURE 55

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).
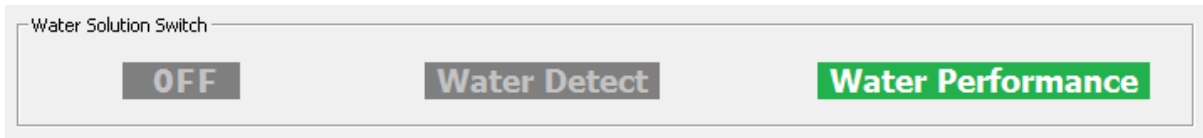
FIGURE 56

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

When choosing WD or WP, building system reference is required to prevent unexpected behaviors during environmental changes. A dialog box will prompt users for building SR, please press Yes button to proceed.
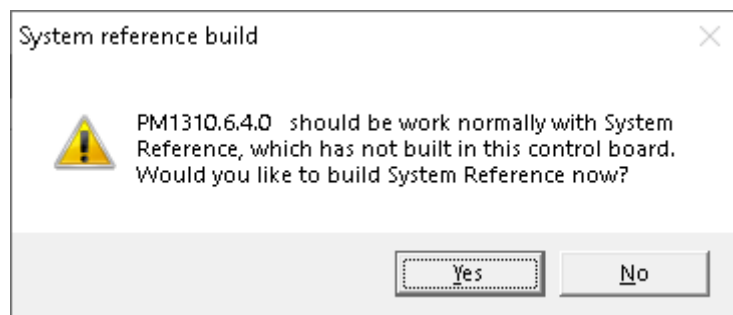
FIGURE 57

After the SR built process finishes, the utility will switch to the Diagnostic "System Reference" page and show built result.
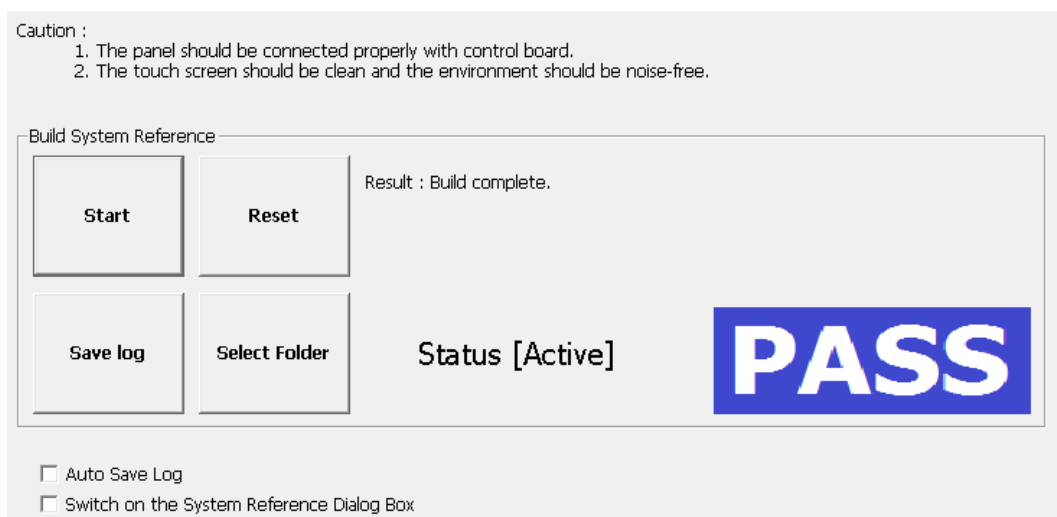
FIGURE 58

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.
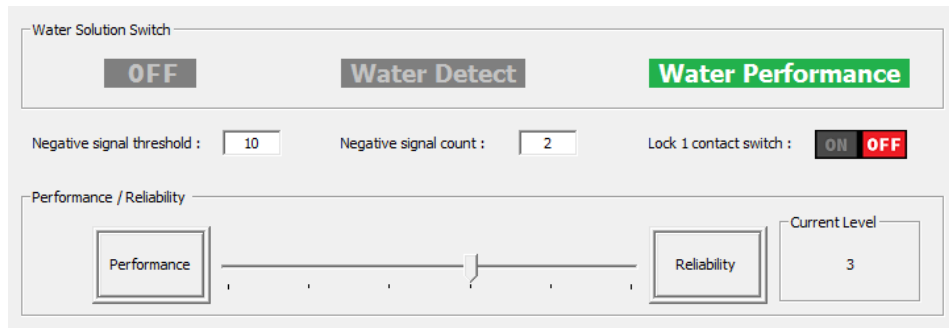
<p align="center">FIGURE 59</p>

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.
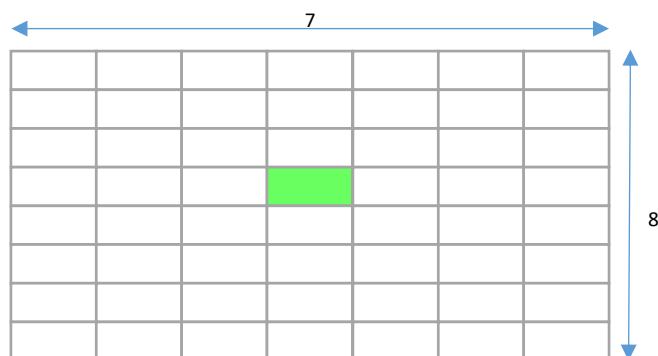
FIGURE 60

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.

FIGURE 61

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.

FIGURE 62

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.
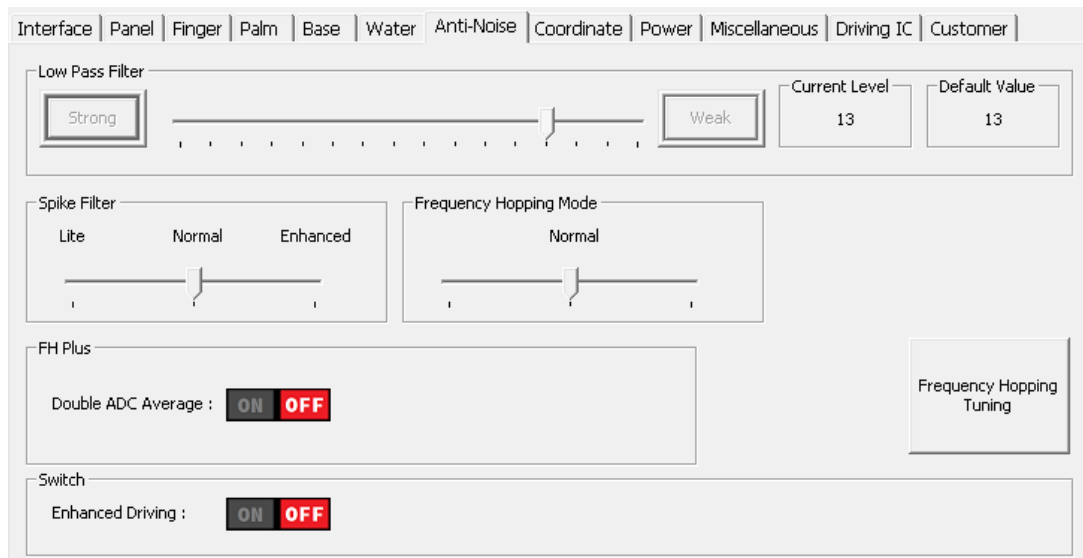
FIGURE 63

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	Lite (0)	Normal (1)	Enhanced (2)	Extreme 1 (3)	Extreme 2 (4)
V6.4 and later	V	V	V	V	V
V6.2 and later	V	V	V		
V6.1 and later		V	V		
V1.0 and later		V			

Please notice that Level 3 and 4 are locked and can only be configured by using the Quick Select feature.

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.
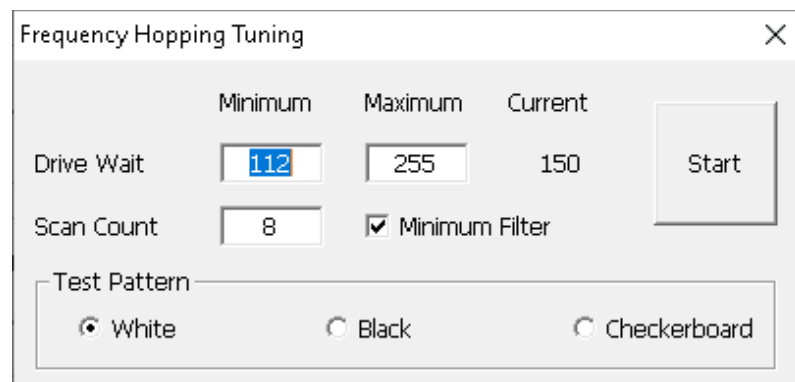
Figure 64

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.
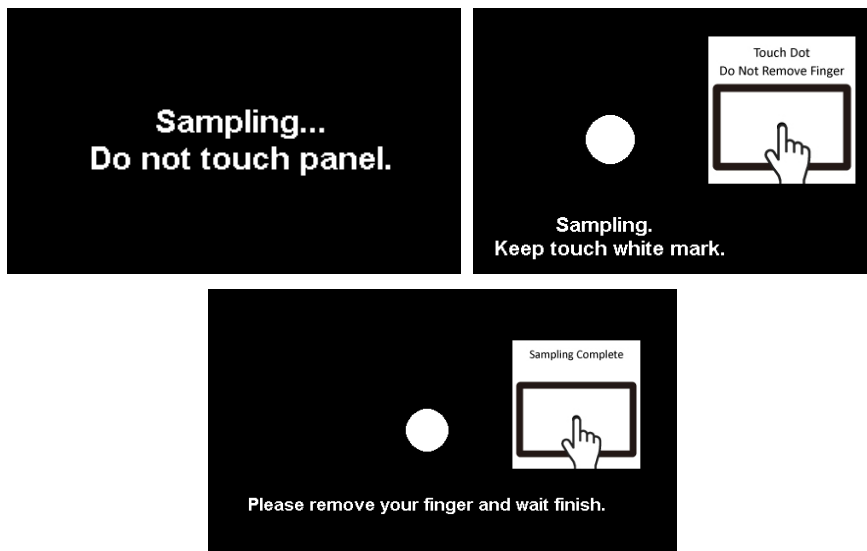
Figure 65

- 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.
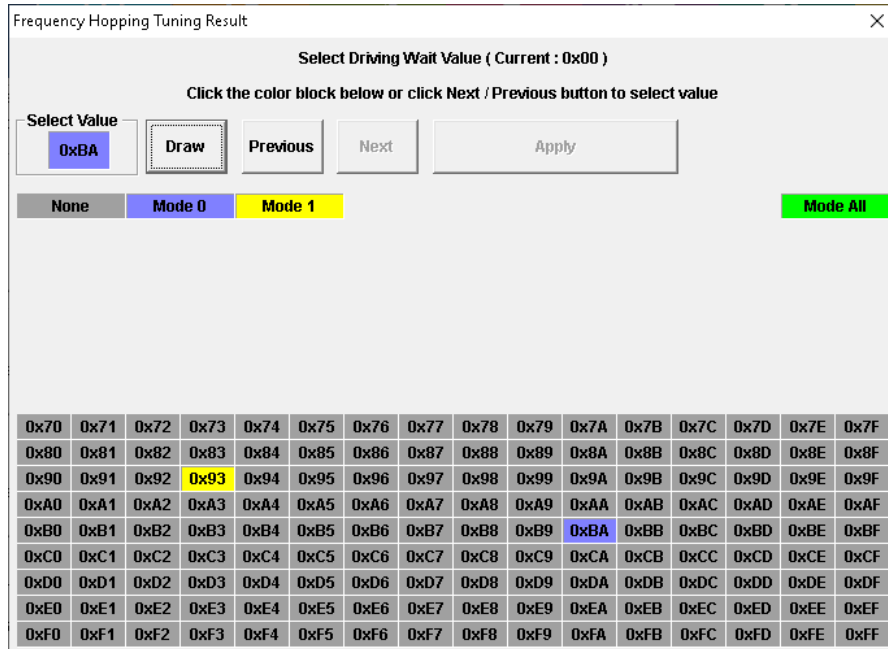
Figure 66

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.
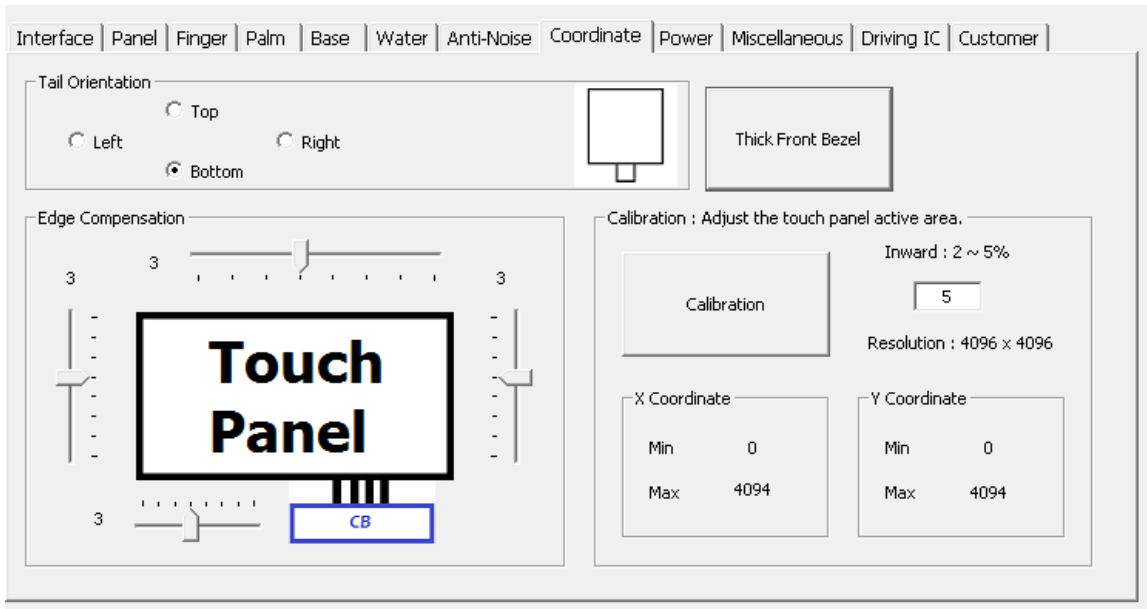
FIGURE 67

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.
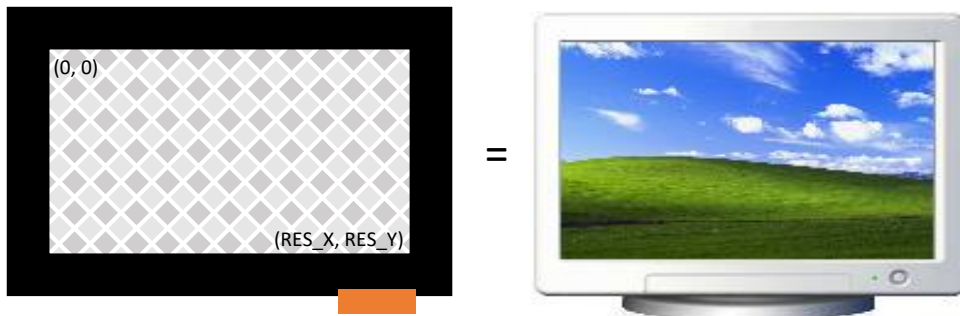
FIGURE 68

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).
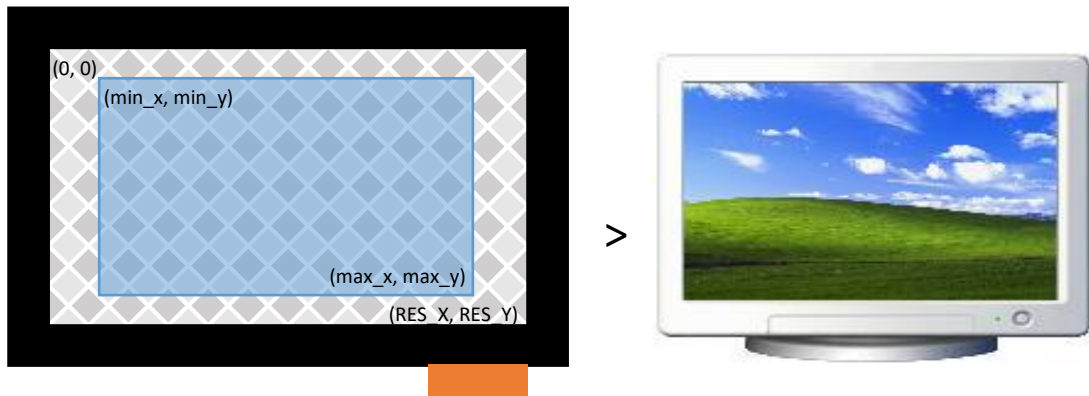
FIGURE 69

(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".
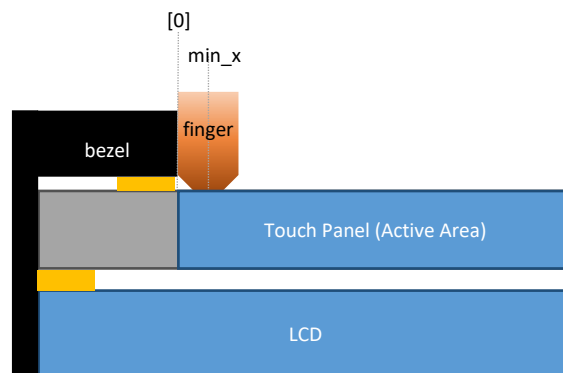
Figure 70

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.
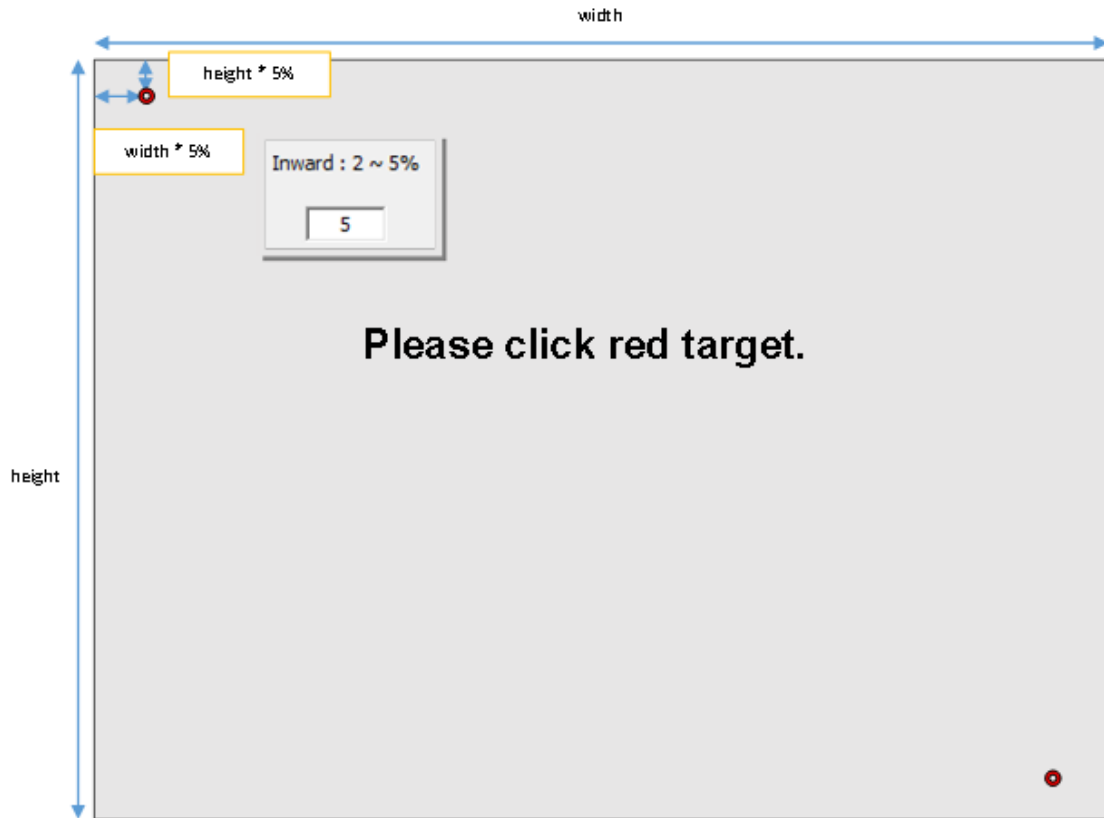
Figure 72

The "inward" setting helps users touch the red square easier, especially when performing calibration on a

FIGURE 71

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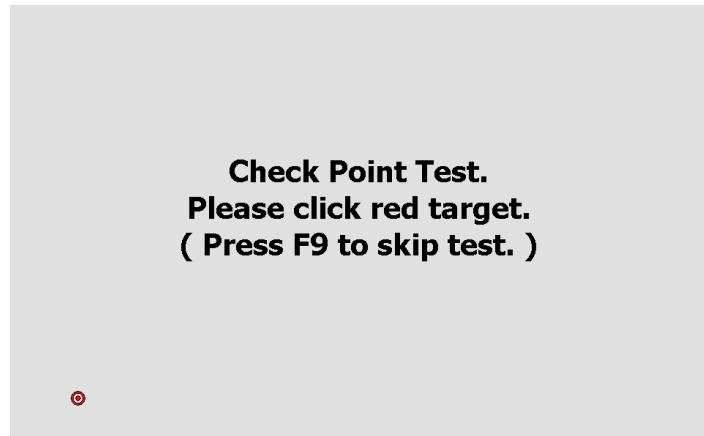
If the test fails, the program will prompt for another confirmation and users can still choose to apply the calibration result by pressing the "yes" button on screen.

**Check Point Test Failed.
Do you want to save
calibration data?**

Yes	No
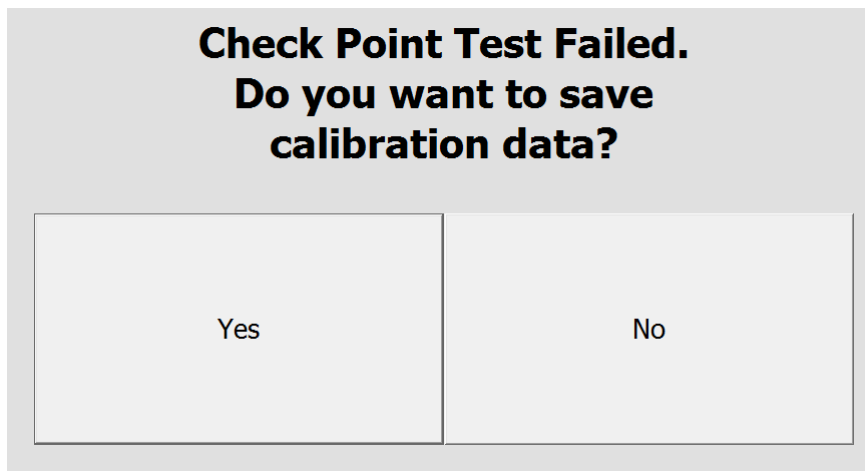
4.9.2   Edge Compensation

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 75

4.9.4 Thick Front Bezel Configuration (V6.4 / V6.5 Only)

The button will open a new window that configures the "Thick Front Bezel Support" feature available in firmware V6.4 and V6.5. When enabled, touch will be adjusted to screen borders when the position reaches the criteria.

FIGURE 76

- Switch

    Enable or disable this feature.

- X axis distance

    Defines the x threshold.

    When touch x-axis distance to border is within this range, adjust the x axis value to border.

    It is marked as blue lines in the configuration window.

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- Y axis distance

  Defines the y threshold.

  When touch y-axis distance to border is within this range, adjust the y axis value to border.

  It is marked as blue lines in the configuration window.

- Border between Panel AA

  Defines the border position from panel AA.

  It is marked as dark yellow lines in the configuration window.

4.10 Power Parameters

PenMount supports three power modes: Active Mode, Idle Mode, and Sleep Mode. The transitions are illustrated in the diagram below:
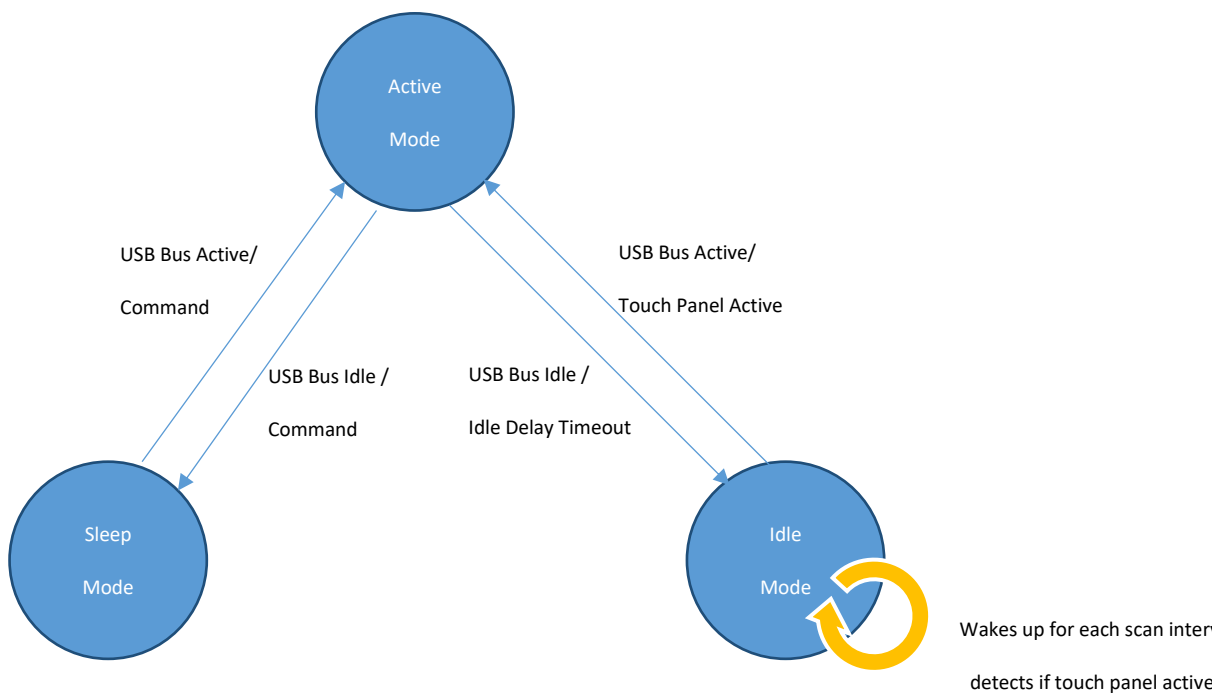
FIGURE 77

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

FIGURE 78

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^{2}C 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".
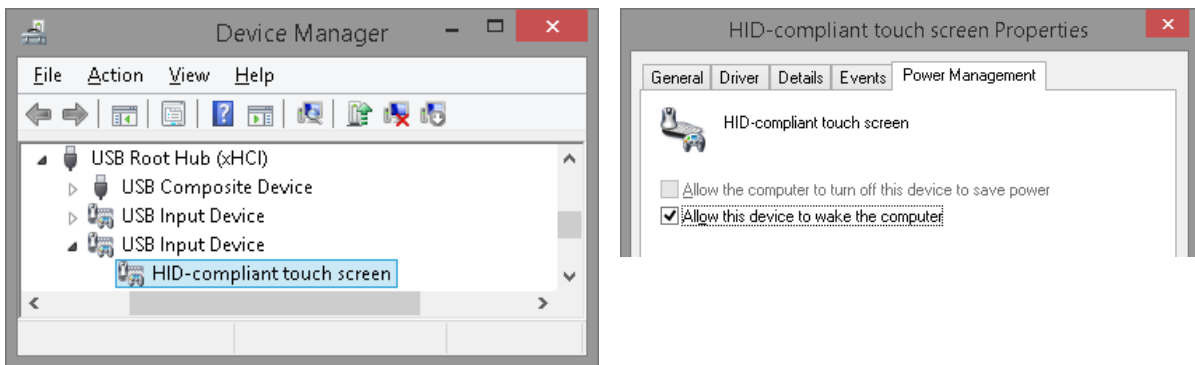
FIGURE 79

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
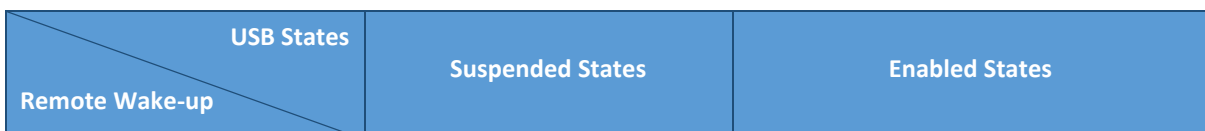
Enable	Idle mode	Active Mode (With Touch)
Disable	Sleep mode	Idle Mode (Without Touch)

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 80

Power Modes	Scan Interval
Idle Mode	Configurable 10ms, 20ms, 30ms, 50ms
Sleep Mode	Scan Stops
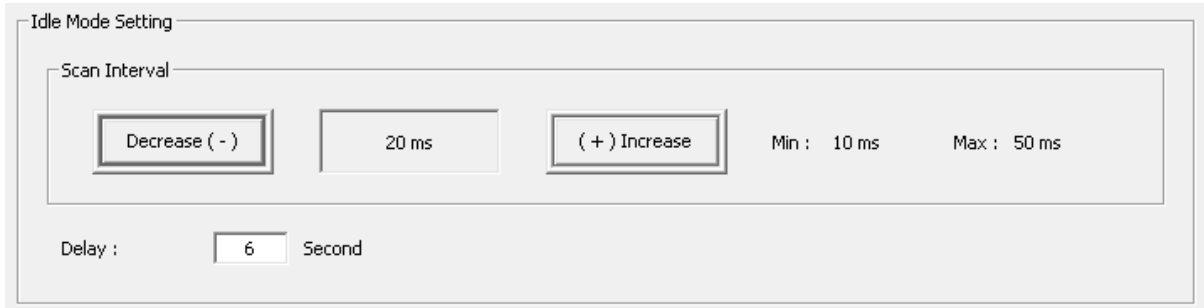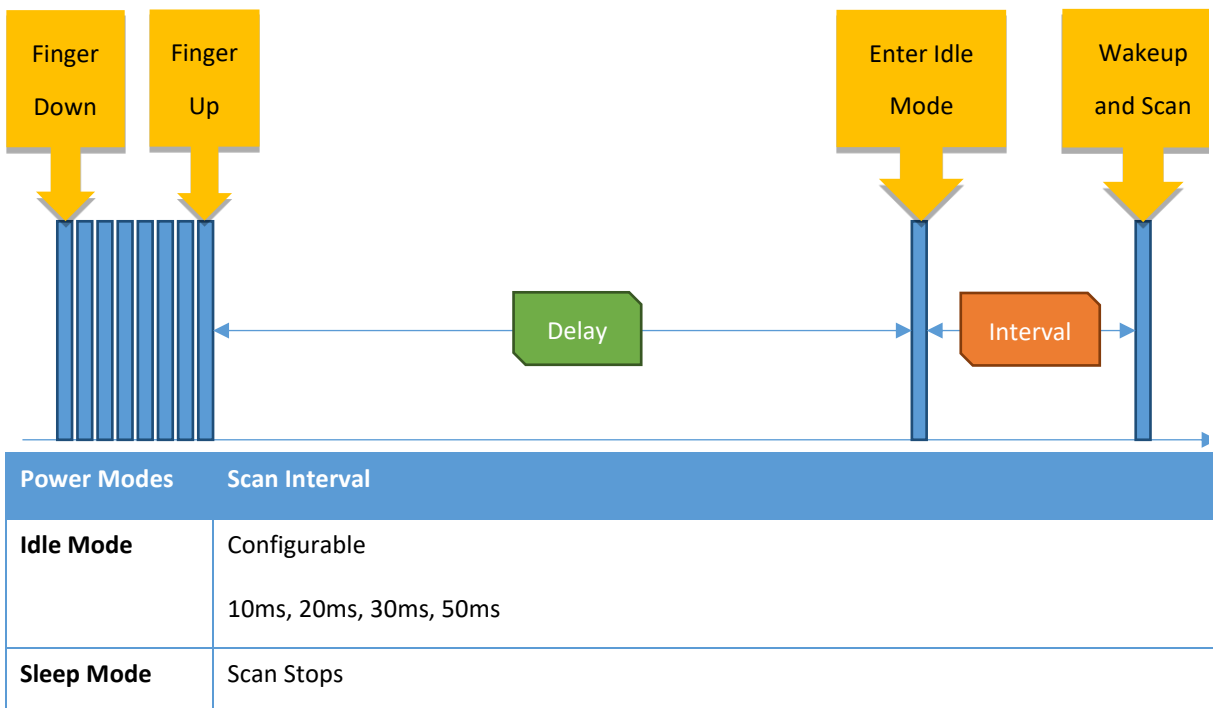
FIGURE 81

4.11 Miscellaneous Features

In the "misc" tab, users can enable or disable firmware supported features.
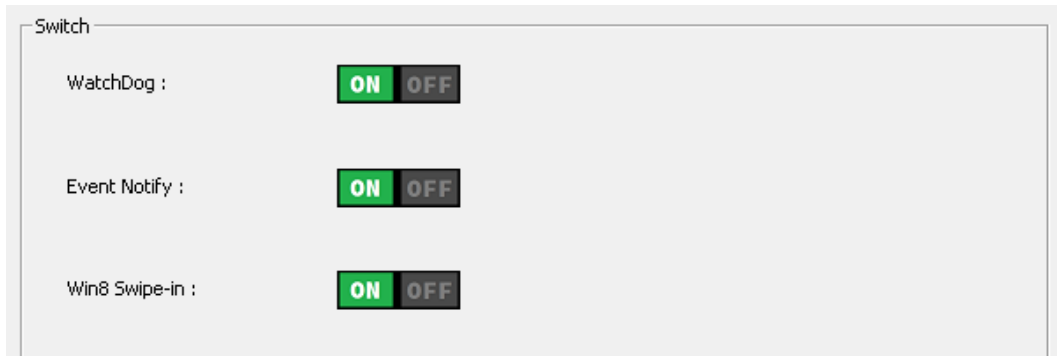
FIGURE 82

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 83

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	

72

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 84

5. Field Update

The field update page allows user to change controller firmware version.
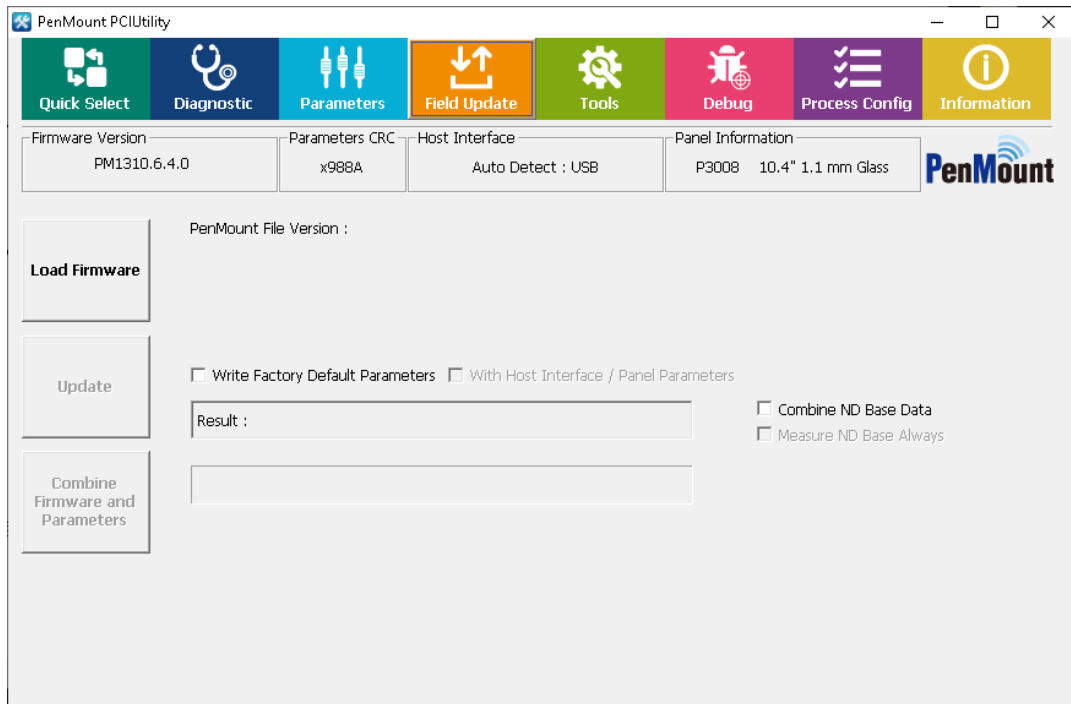
FIGURE 85

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 86

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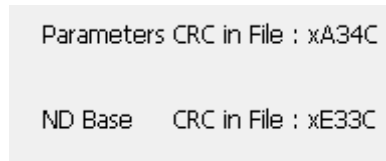
Please note, if the firmware file is not consistent with the controller connected during the update, the update will not proceed.

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.

☑ Write Factory Default Parameters   ☐ With Host Interface / Panel Parameters

Result : Now Programing. Please Wait 0.406(s)

FIGURE 88

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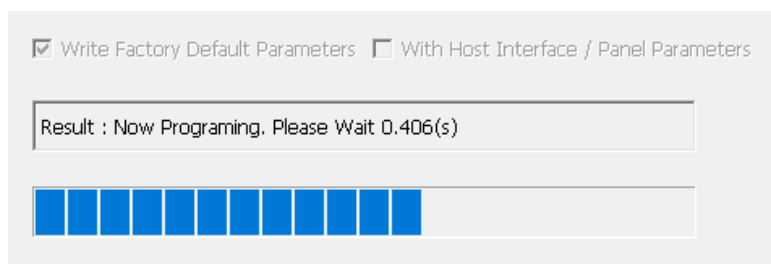
Please wait until update reaches 100%. During the update, please do not interrupt the power supply. After the firmware update is completed, you will see the "PASS" mark.
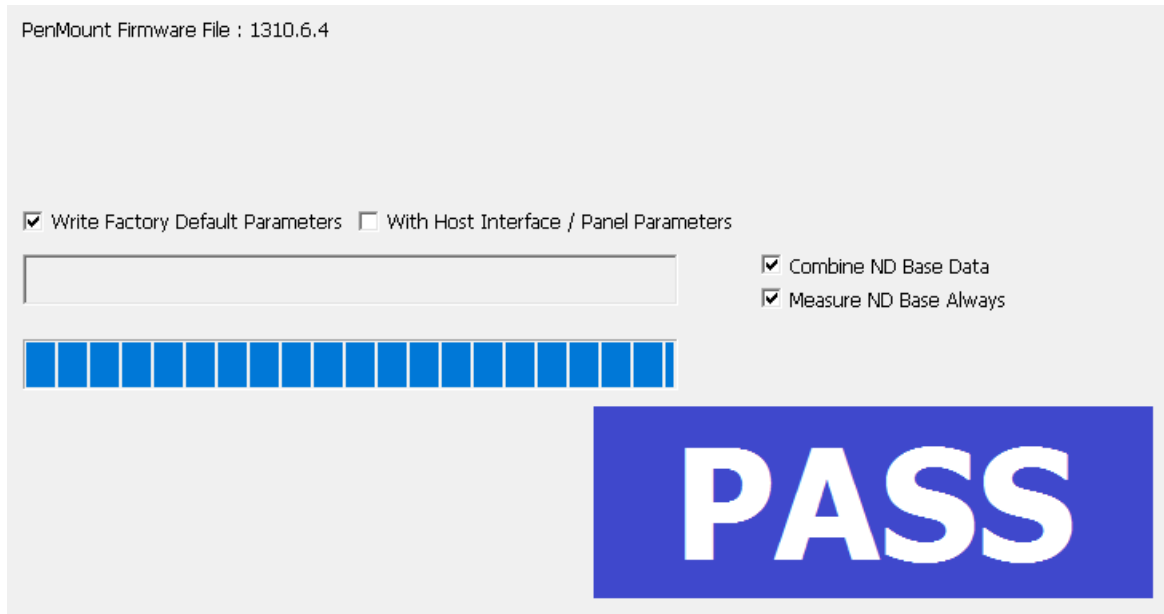
FIGURE 89

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

FIGURE 90

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 91

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.
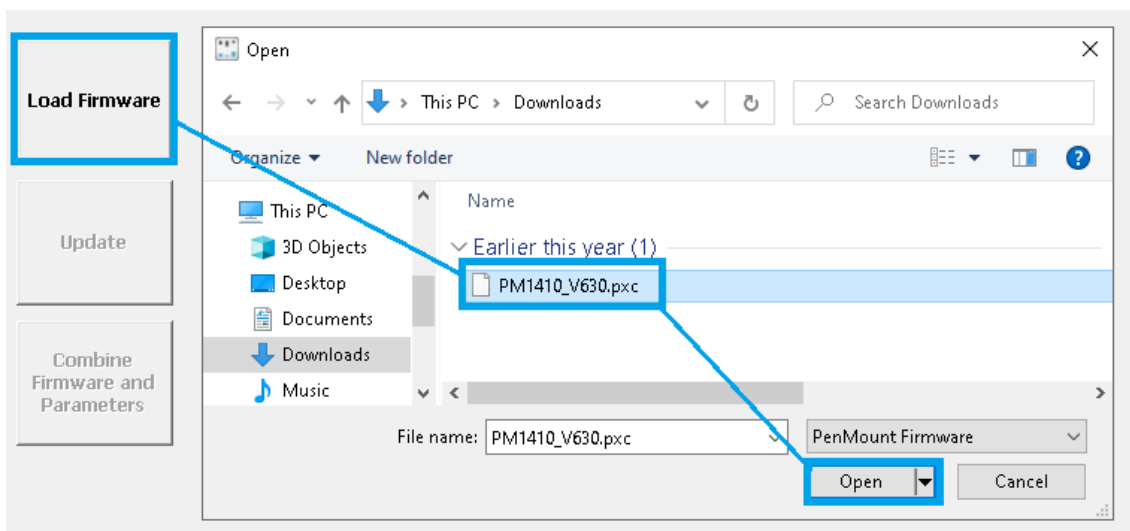
Figure 92

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.
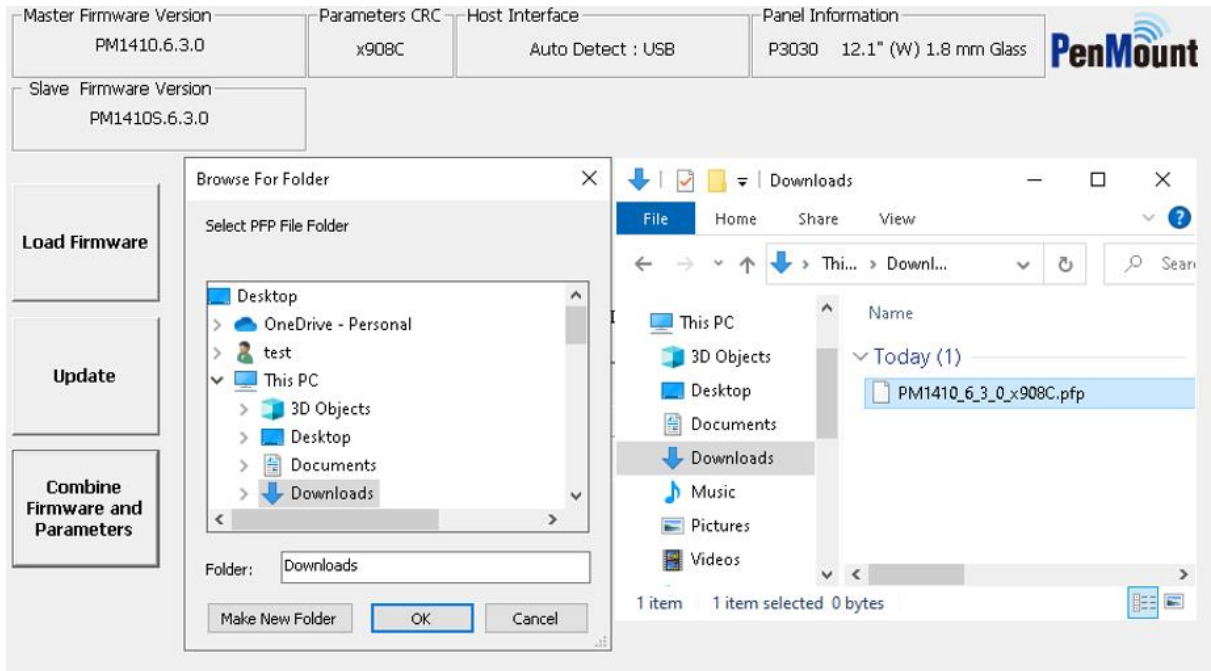
Figure 93

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.
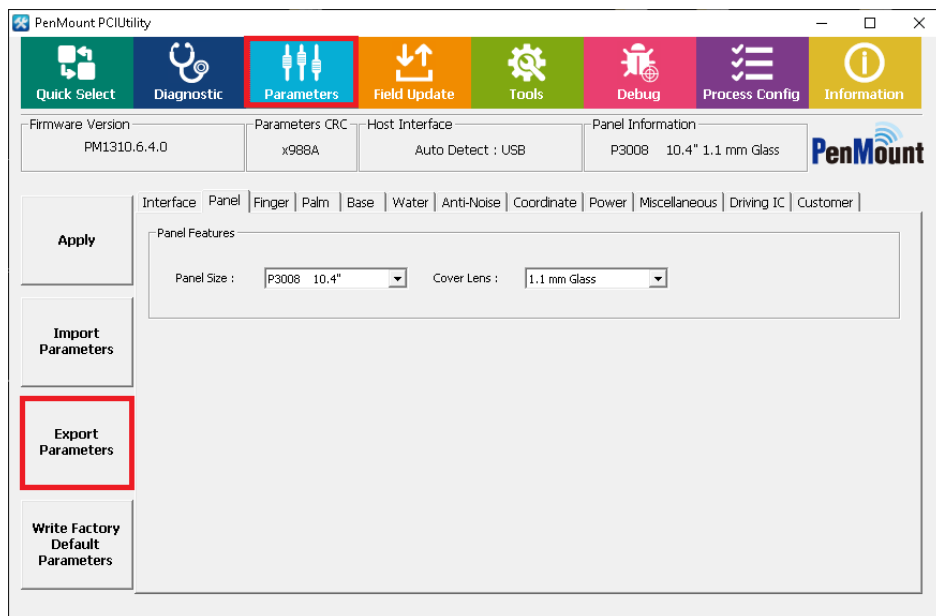
Figure 94

6. Tools

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

Figure 95

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:
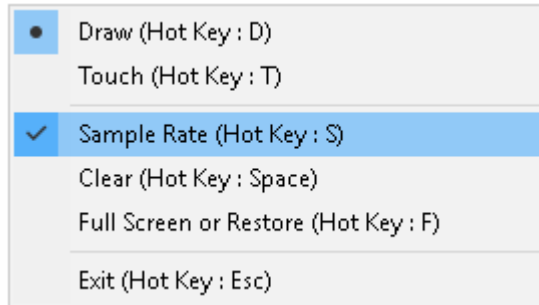
FIGURE 96

- Draw Mode

  Switch to draw mode. In this mode, the program will label touch points in different colors.
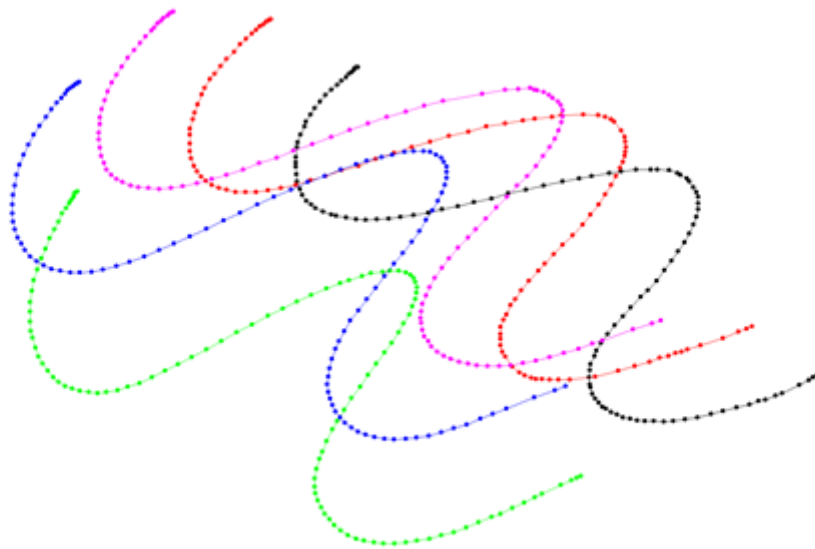
FIGURE 97

- Touch Mode

  Switch to touch mode. In this mode, only the touch point location of your finger is shown.
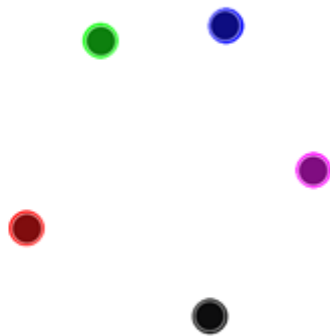
FIGURE 98

- 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.
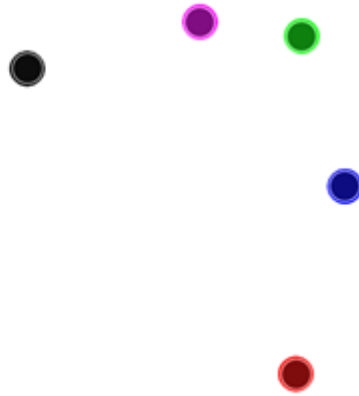
FIGURE 99

- 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.
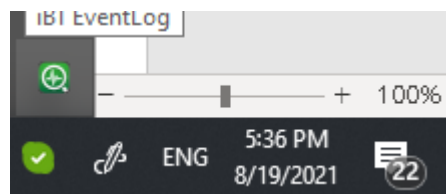
FIGURE 100

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.
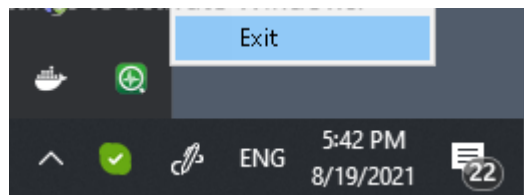
FIGURE 101

6.3.3 Setting

Right click on the utility icon on taskbar and choose Setting in menu.
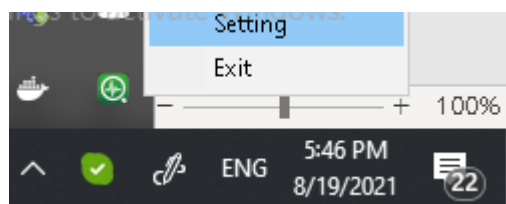
FIGURE 102

The Setting window of iBTEventLog utility will appear.
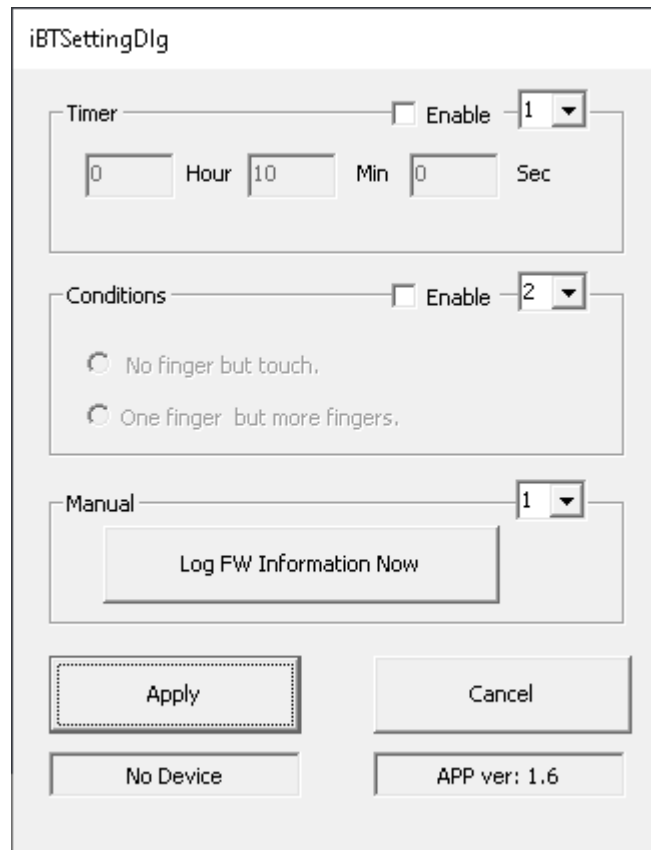
FIGURE 103

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.
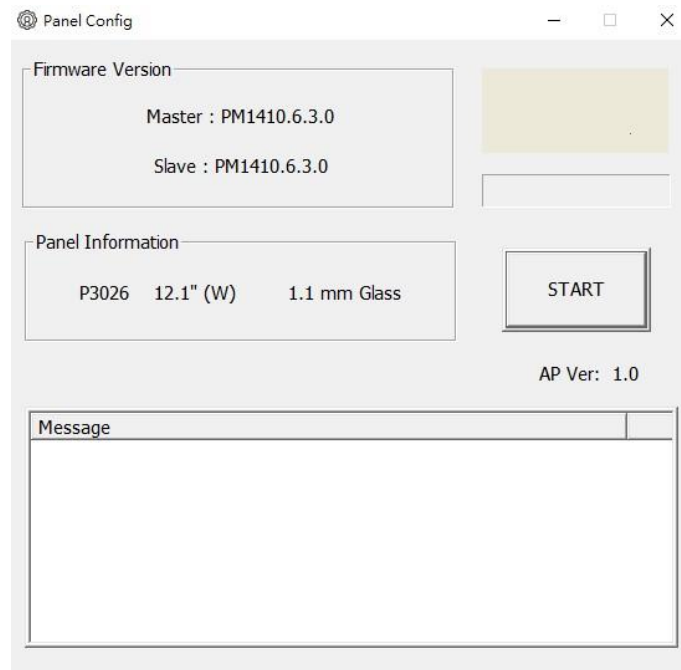
FIGURE 104

2. In Settings window, enter Panel Name, Cover Material, Cover Thickness, Panel Size and Tail Orientation respectively, then press the "Next >" button.
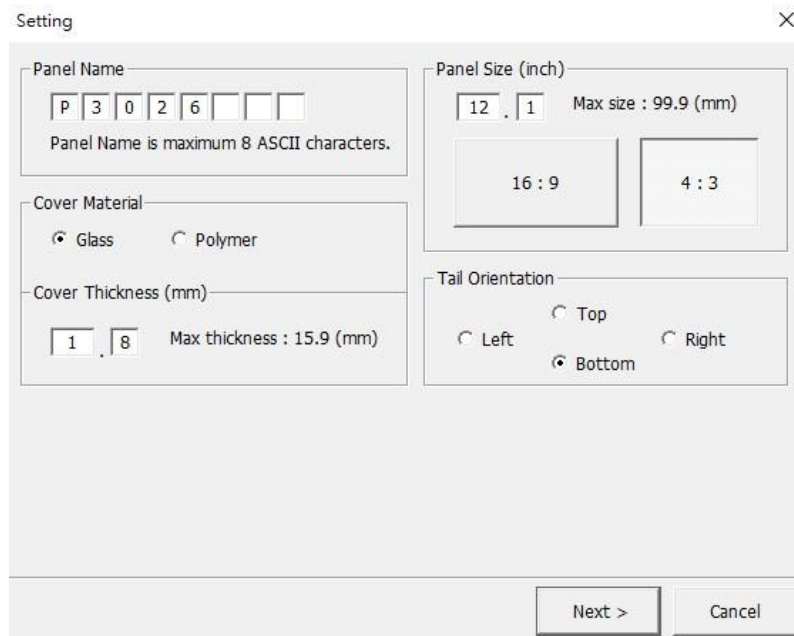
FIGURE 105

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 106

   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.
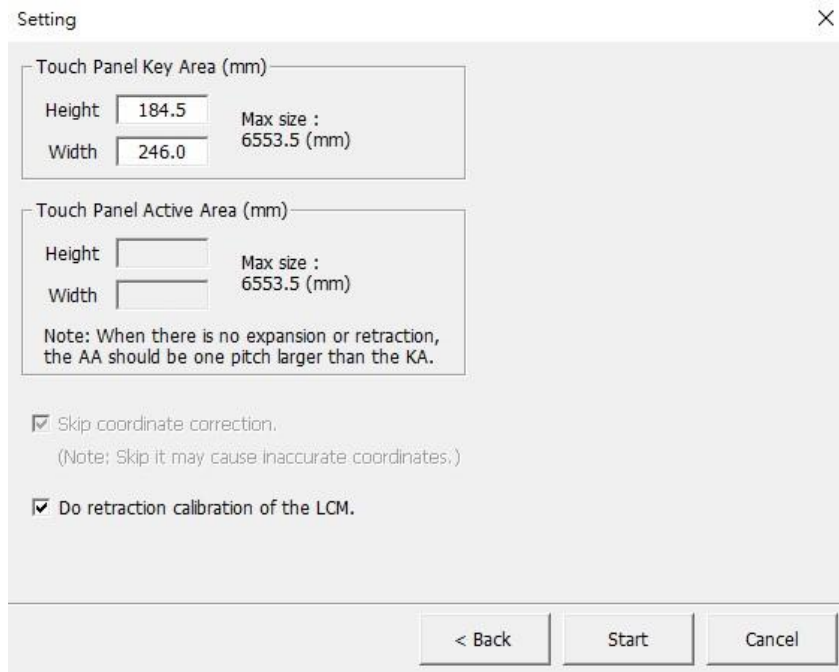
FIGURE 107

- Press Start for detection. Messages appear to notify users to avoid placing hand, dirt, or other objects on touch panel during detection.
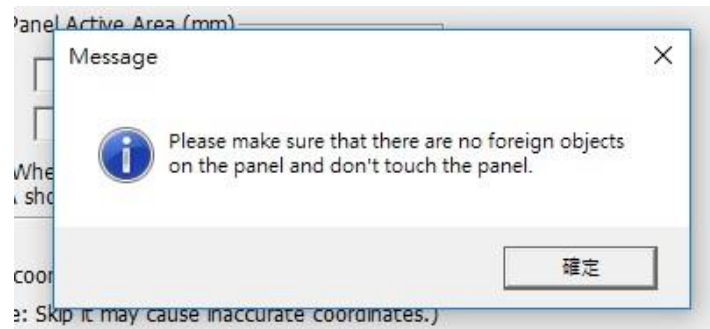
FIGURE 108

- The utility starts full screen data collection, and prompt user not to touch
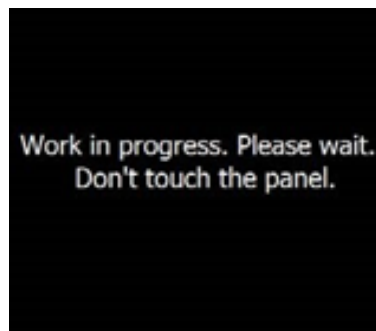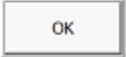
FIGURE 109

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.
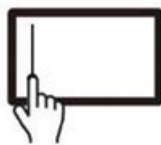
Please draw a line from top left to bottom left.
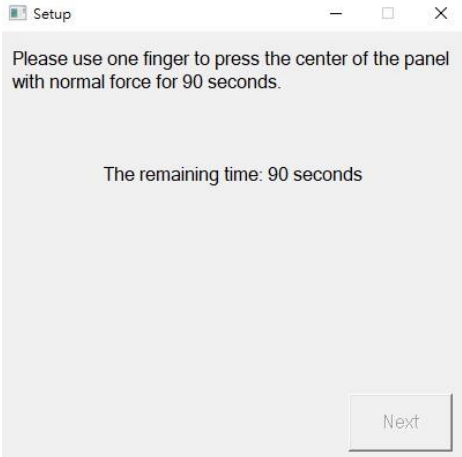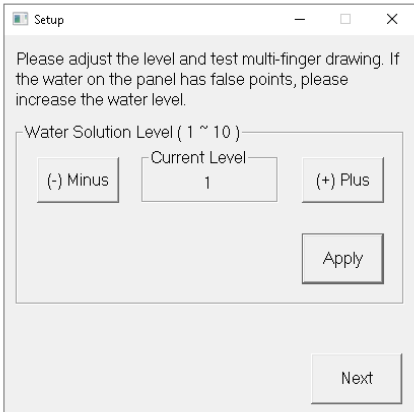
FIGURE 110

11. Tune Water Parameter

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

FIGURE 111

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.	

90

- 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.

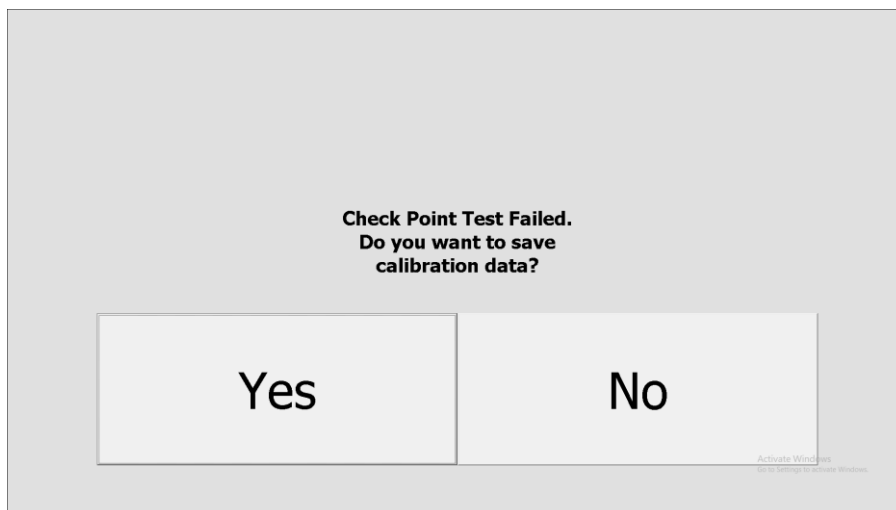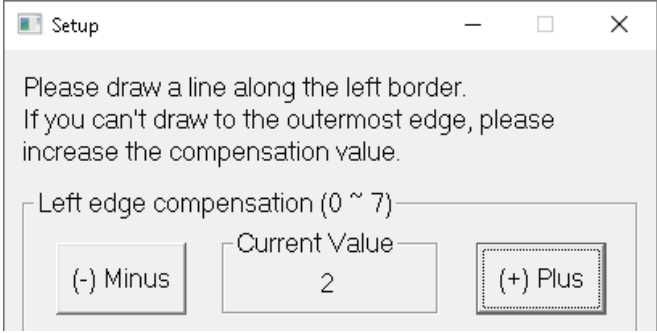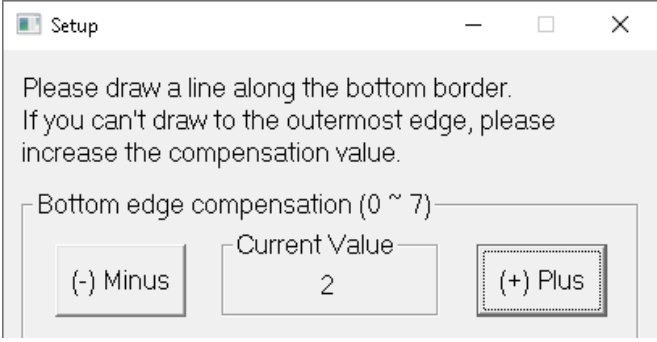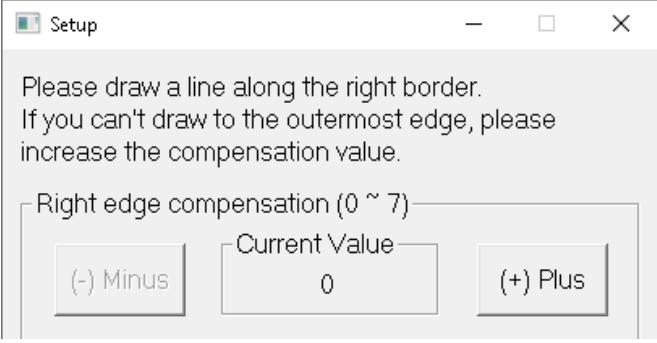However, user can still choose to use the calibration result.

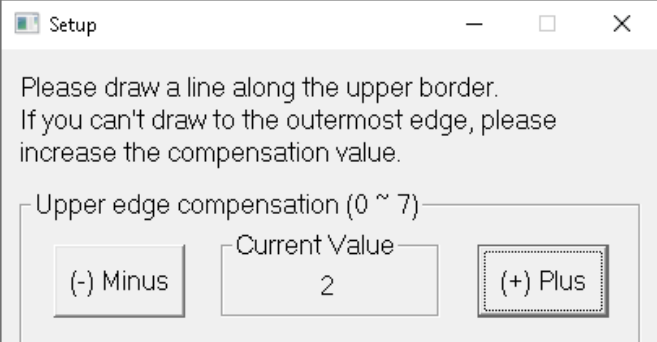**Check Point Test Failed. Do you want to save calibration data?**

Yes   No

● 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	**Setup** — □ ✕ Please draw a line along the left border. If you can't draw to the outermost edge, please increase the compensation value. Left edge compensation (0 ~ 7) Current Value (-) Minus 2 (+) Plus
Bottom Edge	**Setup** — □ ✕ Please draw a line along the bottom border. If you can't draw to the outermost edge, please increase the compensation value. Bottom edge compensation (0 ~ 7) Current Value (-) Minus 2 (+) Plus
Right Edge	**Setup** — □ ✕ Please draw a line along the right border. If you can't draw to the outermost edge, please increase the compensation value. Right edge compensation (0 ~ 7) Current Value (-) Minus 0 (+) Plus
Top Edge	**Setup** — □ ✕ Please draw a line along the upper border. If you can't draw to the outermost edge, please increase the compensation value. Upper edge compensation (0 ~ 7) Current Value (-) Minus 2 (+) Plus

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.
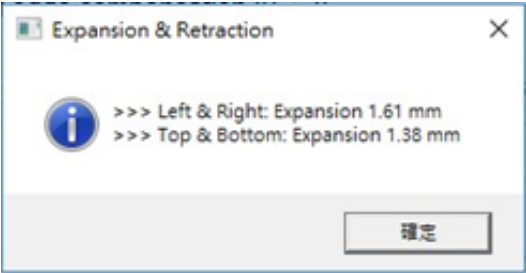
FIGURE 113

7. Debug

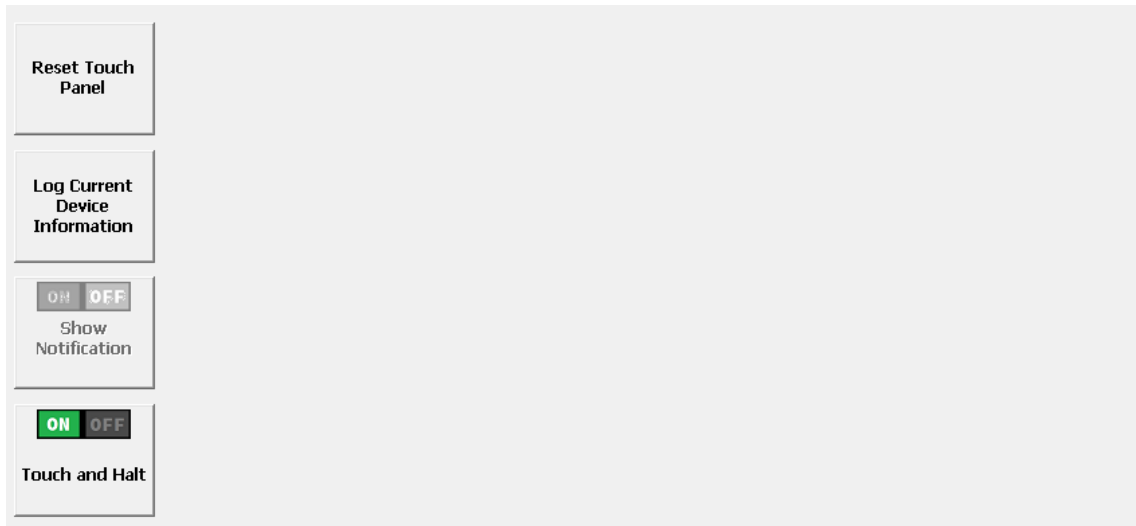The debug panel provides several features for analysis of touch status and debugging touch issues.

FIGURE 114

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.

FIGURE 115

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. Please specify the <log file name> in the Save As dialog box.
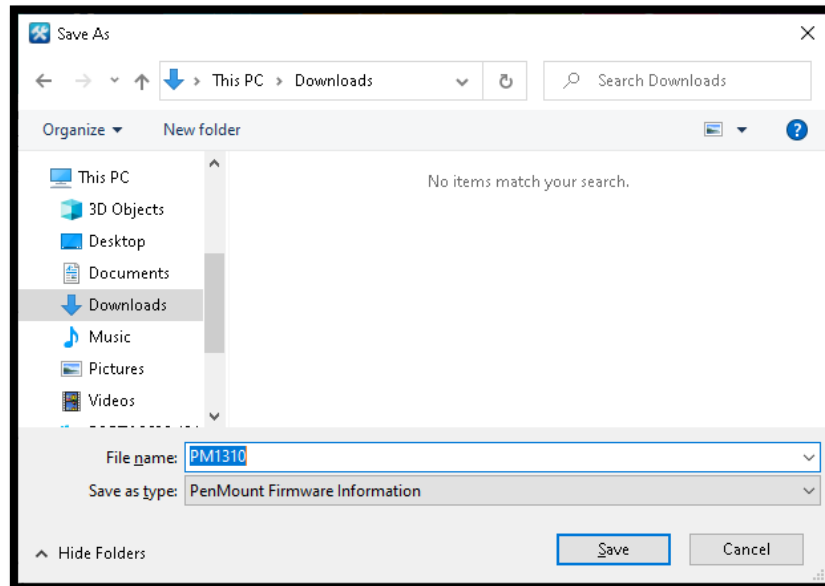

FIGURE 116

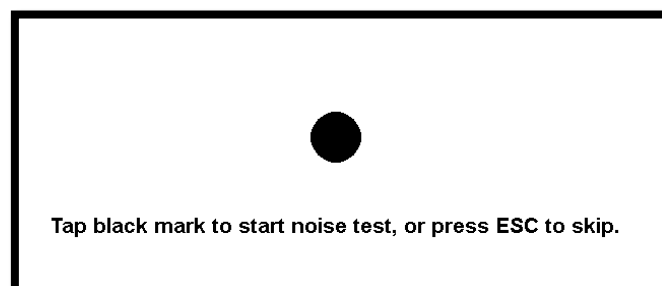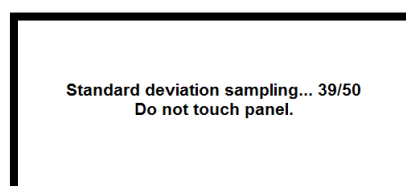When user starts the test, tap the black mark to start noise test.

FIGURE 117
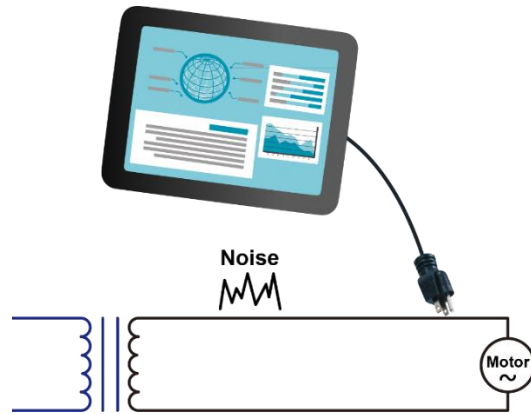
Then, do not touch panel while the firmware is sampling.

FIGURE 118

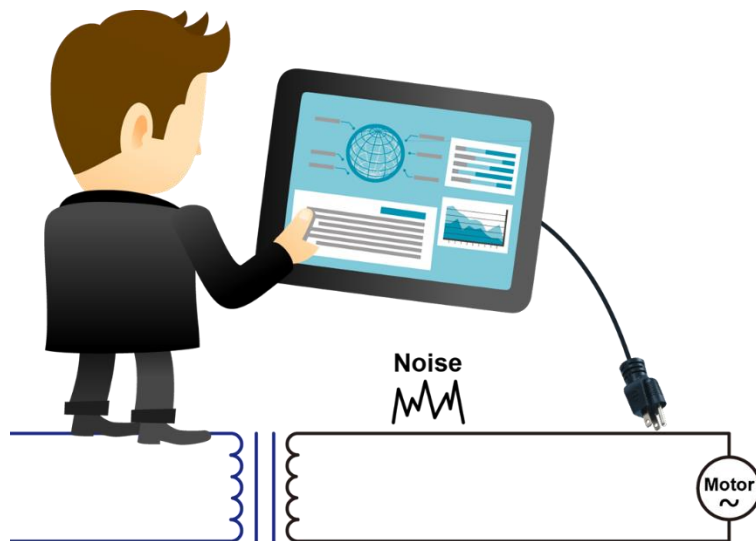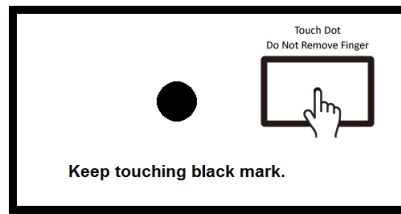When the screen shows the black point, please keep touch it until the process is finished.

Touch Dot
Do Not Remove Finger

Keep touching black mark.

FIGURE 119

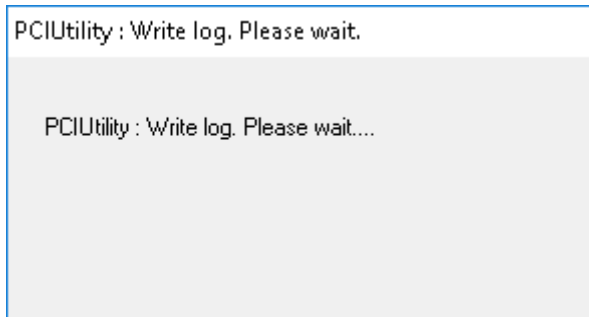Finally, please wait for the "Write log finish" message to appear.

FIGURE 120

The file consists of the useful information for debugging touch issues. The utility will also export current firmware parameters to INI file named:

<log file name>_ParameterList_<CRC>.ini

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.
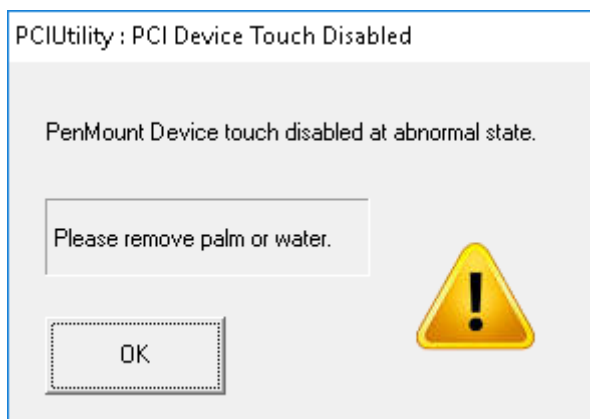

FIGURE 121

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.
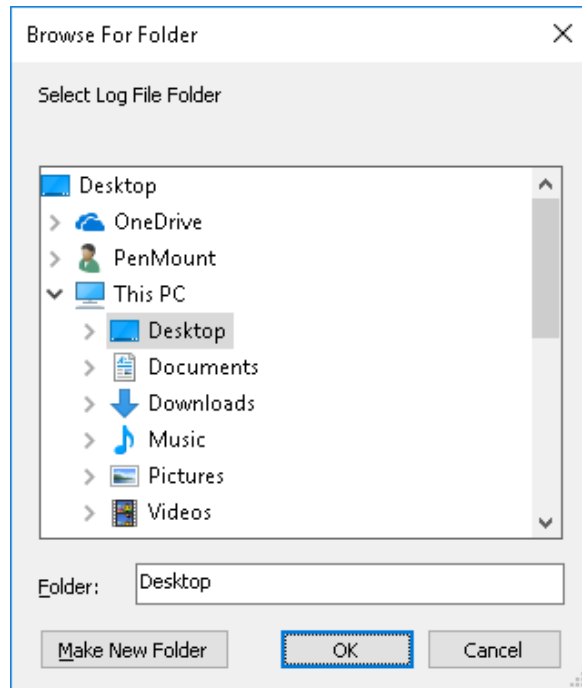
FIGURE 122

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.

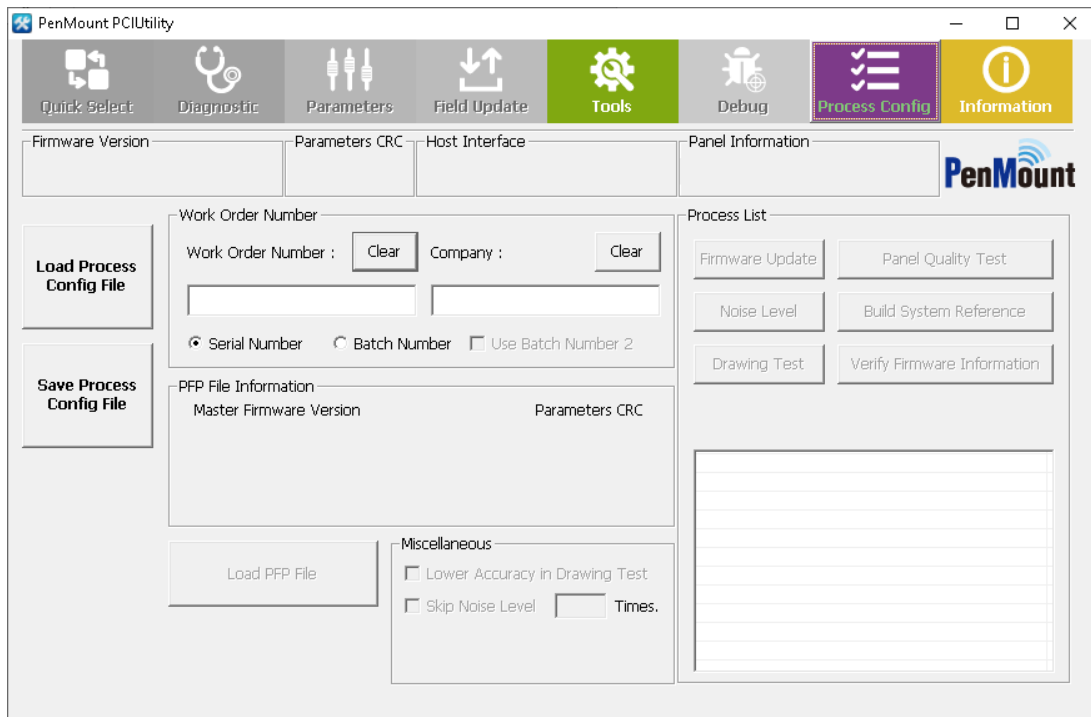This feature is accessible without PenMount device connected.

FIGURE 123

- 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 124

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 125

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 / 100 sec

Please draw a line along the test area.

Time out: 06 / 100 sec
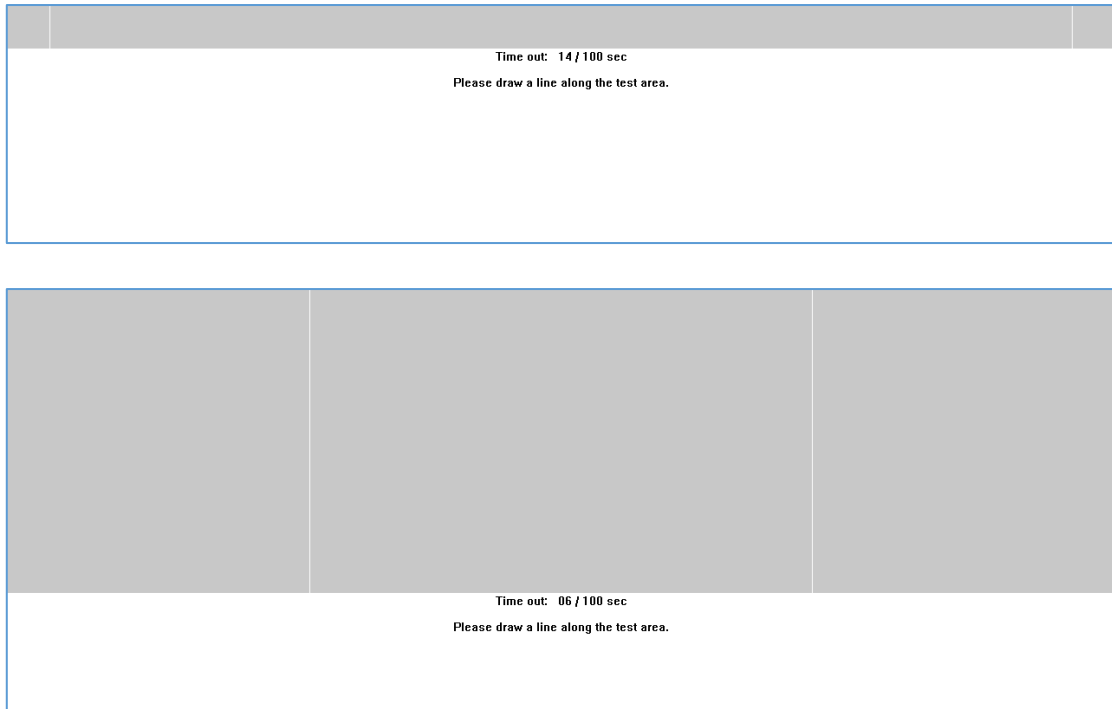
Please draw a line along the test area.

FIGURE 126

- 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.
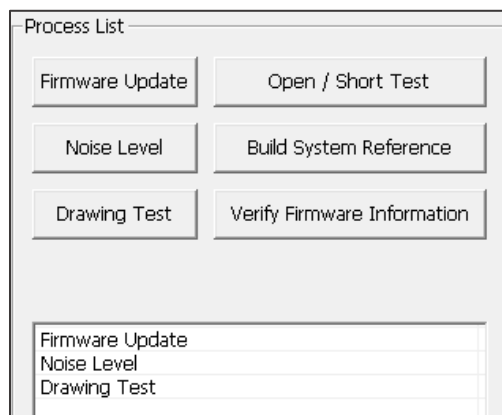
FIGURE 127

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.	