Virtins® Pocket Multi-Instrument 1.0 Manual

This manual contains manuals for VIRTINS Pocket Oscilloscope, VIRTINS Pocket Spectrum Analyzer and VIRTINS Pocket Signal Generator. If you have only purchased individual instrument, then only the relevant portion of this document is applicable.

Note: VIRTINS TECHNOLOGY reserves the right to make modifications to this manual at any time without notice. This manual may contain typographical errors.
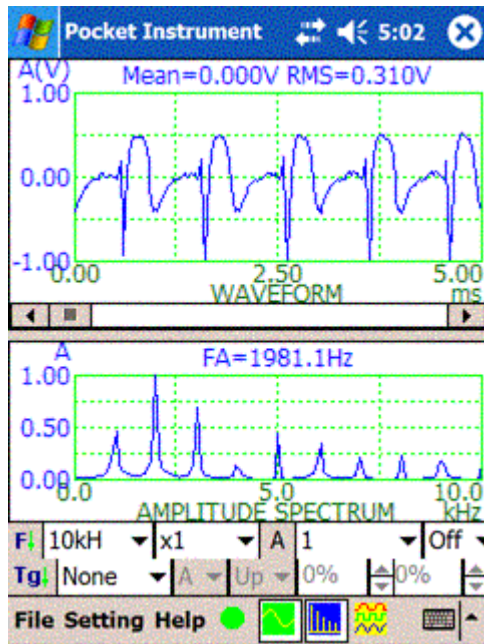
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1 Introduction

1.1 Overview

VIRTINS Pocket Multi-Instrument is a powerful Pocket PC based virtual instrument. It consists of:

1. A dual channel Oscilloscope**,** with all of the features of a modern digital storage oscilloscope, providing four types of views:

- Real time waveform display of Channel A and Channel B

- Real time waveform display of Channel A + Channel B

- Real time waveform display of Channel A - Channel B

- Real time Lissajous Pattern display for Channel A and Channel B

2. A dual channel Spectrum Analyzer, providing four types of views:

- Real time Amplitude Spectrum display

- Real time Phase Spectrum display

- Real time Auto Correlation display

- Real time Cross Correlation display

with adjustable FFT points ranging from 128 to 32768 and selectable windowing functions such as Rectangle, Triangle, Hanning, Hamming, Blackman.

3. A dual channel Signal Generator (Sweep/Arbitrary/Function Generator), providing the following types of waveform for output:

- Sine

- Square

- Triangle

- Saw Tooth

- White Noise

- Pink Noise

- Multi-tones

- Arbitrary via user-configurable waveform library

at either a fixed frequency, or a frequency that sweeps linearly or logarithmically within specified frequency range and time duration.

The sound device embedded inside the Pocket PC is used as the signal input and output device and no additional A/D and D/A hardware are required. The sampling frequency is dependent on the capability of the embedded sound device. The software allows you to select any sampling frequency supported by your Pocket PC sound device up to 96,000 Hz.

For VIRTINS Pocket Oscilloscope and VIRTINS Pocket Spectrum Analyzer, it is possible to specify a trigger event for collecting a frame of data. A negative or positive trigger delay can be specified so that collecting data can be started before or after the trigger event. The software features a specially designed data acquisition approach which is able to monitor the input signal continuously without missing any trigger event, before the frame of data is collected into the Pocket PC memory after the trigger event is found. This makes the software suitable for transient signal recording for up to 500 seconds as long as the memory allows.

The software supports the calibration of the input and output signal so that the absolute value can be used for display, analysis or output.

Zooming and Scrolling is supported in the views of Oscilloscope and Spectrum Analyzer, enabling you to investigate the fine details of the data curves. This is very important when a large amount of data are displayed on the small screen of a Pocket PC. Two markers are provided in each view to get the x and y readings at the points of stylus tapping. The difference in the readings between the two points are also reported. Statistical data such as Maximum value, Minimum value, Root Mean Square value, Frequency Peak Location and Cross Correlation Peak Location are also calculated and displayed for each collected frame of data.

The collected frame of data can be saved as wave files (*.wav) or exported as text files (*.txt) via Oscilloscope. The result of the spectrum analysis or correlation analysis can be exported as text files (*.txt) via Spectrum Analyzer. A wave file with PCM format can be imported for analysis. The signal generated by Signal Generator can be saved as wave files (*.wav) for a given duration up to 1000 seconds as long as the spare storage space in the Pocket PC is enough. The saved wave file can be in turn imported for display and analysis or used by other software.

1.2 System Requirement

Pocket PC with Window Mobile 2003 or later with ARM/XScale based processor.

1.3 Input & Output Connection

The software accepts input from either the built-in microphone or external device connected via the external microphone pin in the headset jack. Almost all Pocket PCs have a built in microphone. But only some Pocket PCs support external microphone. Pocket PCs that support external microphone are: Axim X50, X51 series, iPAQ 4700, 5400, 5500, 6300, 2700 series......

For the Signal Generator, the signal is output via the stereo output pins in the headset jack or directly via the speaker.

1.4 Specification

1.4.1 VIRTINS Pocket Oscilloscope

1. Scan Time: 100 μs~500 s (depending on Computer Memory)

2. Bandwidth: 20 Hz - 48 kHz (depending on Sound Device)

3. Input Level: about 1 VAC (depending on Sound Device)

4. Selectable sampling frequency (up to 96 kHz), sampling bit resolution (8 or 16 bits) and sampling channels (one or two) (all depending on Sound Device)

5. Three triggering modes: no trigger, repeated trigger and single trigger.

6. Support triggering by leading edge or trailing edge at specified triggering level and on selected input channel

7. Support pre-triggering and post triggering from 0 to 100% of the selected sampling length

8. Continuous monitoring on the input signal such that no trigger event will be missed before data collection.

9. Can be used as a transient signal recorder to capture and store data for up to 500s

10. Four view types: Real time waveform display of Channel A and Channel B, Real time waveform display of Channel A + Channel B, Real time waveform display of Channel A - Channel B, Real time Lissajous Pattern display for Channel A and Channel B

11. Independent X axis and Y axis zooming and scrolling

12. WAV file can be imported for display and analysis

13. Collected measurement data can be saved as WAV file or exported as TXT file

14. Support calibration of the input channels

15. Support adding notes to the measurement data

16. Features fast display refresh rate, thus data are displayed and analyzed in "true" real time

17. The colors of display are configurable

18. Number of points to be collected per scan can be fine tuned

19. Displays the Maximum, Minimum, Mean, RMS value of the data per scan. Therefore it can be used as a voltmeter

20. Support two markers on each view

1.4.2 VIRTINS Pocket Spectrum Analyzer

1. Frequency Range: up to 48 kHz (depending on Sound Device)

2. Bandwidth: 20 Hz - 48 kHz (depending on Sound Device)

3. Input level: about 1 VAC (depending on Sound Device)

4. Selectable sampling frequency (up to 96 kHz), sampling bit resolution (8 or 16 bits) and sampling channels (one or two) (all depending on Sound Device)

5. Three triggering modes: no trigger, repeated trigger and single trigger

6. Support triggering by leading edge or trailing edge at specified triggering level and on selected input channel

7. Support pre-triggering and post triggering from 0 to 100% of the selected sampling length

8. Continuous monitoring on the input signal such that no trigger event will be missed before data collection

9. Can be used as a transient signal recorder to capture and store data for up to 500s

10. Four view types: Real time amplitude spectrum display (relative display mode and absolute display mode (RMS mode)), Real time phase spectrum display, Real time auto correlation display, Real time cross correlation display

11. Independent X axis and Y axis zooming and scrolling

12. Support independent linear or logarithmic scale for x axis and y axis

13. WAV file can be imported for display and analysis

14. Collected measurement data can be saved as WAV file or exported as TXT file

15. Support calibration of the input channels

16. Support adding notes to the measurement data

17. Features fast display refresh rate, thus data are displayed and analyzed in "true" real time

18. The colors of display are configurable

19. Number of points to be collected per scan can be fine tuned

20. FFT size can be adjusted from 128 to 32768 points

21. Allows sampling length to be different from FFT size. If the FFT size is greater than the sampling length, then zero will be added at the end of the actual measurement data during FFT computation. If the FFT size is less than the sampling length, then the measurement data will be split into different segments with the size of each segment equal to the FFT size. The final result will be obtained by averaging the FFT results from all segments

22. Support windowing functions: Rectangle, Triangle, Hanning, Hamming and Blackman

23. Displays the frequency and cross correlation peak location

24. Support two markers on each view

25. Options are provided to remove the DC component during spectrum analysis.

1.4.3 Virtins Pocket Signal Generator (Sweep/Arbitrary/Function Generator)

1. Bandwidth: 20 Hz - 48 kHz (depending on Sound Device)

2. Output level: about 1 VAC (depending on Sound Device)

3. Selectable sampling frequency (up to 96 kHz), sampling bit resolution (8 or 16 bits) and sampling channels (one or two) (all depending on Sound Device)

4. Support predefined waveforms: Sine, Square, Triangle and Saw Tooth. They can be generated at a specified fixed frequency ranging from 1 Hz to up to 48 kHz

5. Support pink noise and white noise generation

6. Support multi-tones generation. Multi-tones is a combination of predefined waveforms with different amplitude and frequency. Pink noise and white noise with specified amplitude can also be added into multi-tones. Maximum 32 tones can be combined in each channel

7. Support arbitrary waveform generation through user-defined waveform library. The waveform library is a TXT file containing the relative coordinates of each point of a waveform. There is no limit as to how many points can be used to define a waveform.

8. The predefined waveform, multi-tones and user-defined waveform can be generated at a frequency that sweeps linearly or logarithmically within specified frequency range and time duration

9. Allows to specify the phase difference between the two channels if the output signals have the same frequency

10. The output signal amplitude is adjustable

11. The generated signal can be saved as WAV file or TXT file for a specified duration ranging from 1s to 1000s

12. Support calibration of the output channels

13. The output signal can be displayed in the Oscilloscope and Spectrum Analyzer at real time via software loop back.

1.5 Precaution

Signal with high voltage can easily burn your sound device or even your Pocket PC. Be extremely careful and strictly follow your Pocket PC Manufacturer's Manual when connecting to external devices. Do not connect to signal with unknown amplitude. If the signal amplitude is high, attenuate it first before connecting to your Pocket PC.

To avoid personal injury, always follow the usual safety rules when working with electric circuits.

IN NO CASE THE AUTHOR AND PUBLISHER OF THE SOFTWARE IS RESPONSIBLE FOR PERSONAL INJURY, HARDWARE AND/OR DATA DAMAGE, PROPERTY DAMAGE OR PROFIT LOSS ARISING FROM USE OR INABILITY TO USE THE SOFTWARE.

2 Oscilloscope
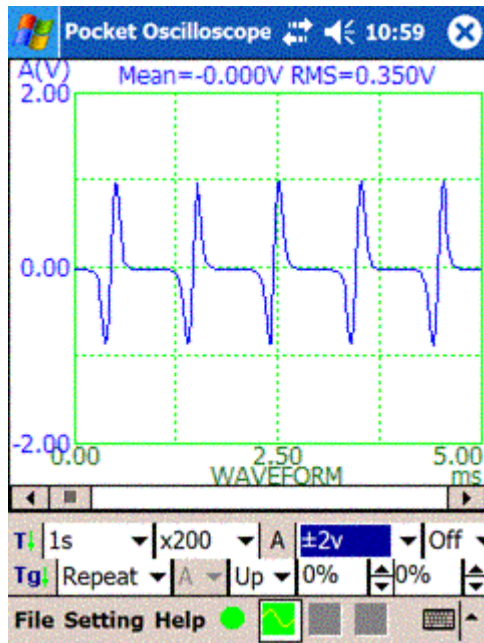
2.1 Trigger Parameters

For the Oscilloscope and Spectrum Analyzer, it is possible to specify a trigger event for collecting a frame of data. There are two concurrent processes in this context, one is data sampling & collecting, the other is data analysis & display. Once a frame of data is collected into computer memory, it will start immediately to search for the next trigger event in order to collect the next frame of data. Meanwhile, the collected data will be analyzed and then displayed. With the fast PC nowadays, normally data analysis and display will take lesser time than data sampling and collecting as the latter one is constrained by the scan time and cannot benefit from the fast speed of the PC. In case that the data sampling & collecting process is faster than the data analysis and display process, the latest frame of data will overwrite the previous one even if it has not yet been analyzed and displayed. This is to ensure that data analysis and display will always be performed on the latest collected data.

Tapping [Setting]>[Trigger/Sampling Parameters] will show or hide Trigger/Sampling Parameters Toolbar. This toolbar contains two parts: Trigger Parameters and Sampling Parameters. Tapping on "Tg" on the Trigger Parameter Toolbar or "Sp" on the Sampling Parameter Toolbar will hide itself and bring up the other one.

On the Trigger Parameter Toolbar, the adjustable parameters from left to right are:

2.1.1 Trigger Mode
There are three trigger modes:

- None

  Frames of data are collected, analyzed and displayed continuously without a trigger event.

In this mode, selection for Trigger Source, Trigger Edge, Trigger Level and Trigger Delay is disabled and these parameters are not used.

- Repeat

  Frames of data are collected, analyzed and displayed continuously with a trigger event.

- Single

  One frame of data are collected, analyzed and displayed with the first trigger event found. This mode is ideal for transient signal recording.

2.1.2 Trigger Source

When only Channel A is sampled, the trigger source is fixed at Channel A and is not selectable. When both Channel A and Channel B are sampled, the trigger source is selectable, either Channel A or Channel B.

2.1.3 Trigger Edge

Two types of Trigger Edge can be specified, either "Up" or "Dn" (Down). When "Up" is selected, a trigger event is found when the signal is crossing the specified Trigger Level from below to above. When "Dn" is selected, a trigger event is found when the signal is crossing the specified Trigger Level from above to below.

2.1.4 Trigger Level

Trigger Level is expressed as a percentage of half of the A/D conversion range of the sound device. It is adjustable from -100% to 100%.

2.1.5 Trigger Delay

Trigger Delay is expressed as a percentage of the scan time and is adjustable from –100% to 100%.

2.2 Sampling Parameters

Sampling Parameters together with the Trigger Parameters determine how the data are sampled and collected. The sampling capability is fully dependent on the sound device. Once the sampling parameter is specified and "Run" button is tapped, it will attempt to start sampling using the specified sampling parameters. An error message will pop up if the specified sampling parameters are not supported by the sound device.

Sampling Parameters here are applicable to the Oscilloscope and Spectrum Analyzer.

On the Sampling Parameter Toolbar, the adjustable parameters from left to right are:

2.2.1 Sampling Frequency

The following sampling frequencies can be selected, 2000 Hz, 4000 Hz, 8000 Hz, 11025 Hz, 22050 Hz, 44100 Hz, 48000 Hz, 96000 Hz.

2.2.2 Sampling Channels

Two options are available: A, A&B.

2.2.3 Sampling Resolution

Two options are available: 8 Bit, 16 Bit.

2.2.4 Record Length

Record Length determines how many points will be recorded per scan for each channel. Normally you do not need to specify the Record Length directly as it is implicitly determined by the Scan Time and the Sampling Frequency (Record Length = Scan Time x Sampling Frequency). When you change the Scan Time or Sampling Frequency, the Record Length will be automatically updated accordingly. Under some circumstance, you may want to explicitly specify the record length, for example, you may want the Record Length to be a multiple of 10 or an exponent of 2. Then you can either select or key in the Record Length you want directly. The scan time will then be automatically updated accordingly so that all data points can be accommodated in one scan.

There are 8 options available for you to select: 50, 100, 200, 500, 1000, 2000, 5000, 10000.

Alternatively, you can key in any number for the Record Length as long as the computer memory allows.

2.3 Oscilloscope View Parameters

View Parameters determine how the collected data are displayed and analyzed.

Tapping [Setting]>[Oscilloscope Parameters] will show or hide the Oscilloscope Parameters Toolbar. This toolbar contains two parts. Tapping on "T" on the first part or "B" on the Second Part will hide itself and bring up the other one. Tapping any place inside the Oscilloscope view will bring up the Oscilloscope Parameters Toolbar.

On the Oscilloscope View Parameter Toolbar, the adjustable parameters from left to right are:

2.3.1 Scan Time (T)

There are 21 options for Scan Time (T). They are100 μs, 200 μs, 500 μs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, 50 s, 100 s, 200 s, 500s. This parameter is applicable to all types of views in the Oscilloscope.

2.3.2 Scan Time Multiplier

The Scan Time Multiplier is the zooming factor for T axis. There are 10 options available: ×1, ×2, ×5, ×10, ×20, ×50, ×100, ×200, ×500, ×1000.

When "× 1" is selected, the full Scan Time range is displayed over the width of the view.

If you change the Scan Time Multiplier to "×N" which is greater than 1, then only 1/N of the full Scan Time range is displayed over the width of the view, with a horizontal scrollbar at the bottom, which allows you to scroll over the full range of the Scan Time.

This parameter is applicable to all types of views in the Oscilloscope except Lissajous Pattern display.

2.3.3 Channel A Voltage Display Range

You can specify the Voltage Display range for Channel A. Available options are: Off, ±20 mv, ±50 mv, ±100 mv, ±200 mv, ±500 mv, ±1 v, ±2 v, ±5 v, ±10 v, ±20 v, ±50 v.

When "Off" is selected, the signal in Channel A will not be displayed in the Oscilloscope.

This parameter is applicable to all types of views in the Oscilloscope. It should be noted that in "Channel A + Channel B" view, this voltage display range is for "Channel A + Channel B". Similarly, In "Channel A – Channel B" view, it is for "Channel A – Channel B".

2.3.4 Channel A Voltage Display Range Multiplier

The Voltage Display Range Multiplier for Channel A is the zooming factor for A axis. There are 5 options available: Off, ×1, ×2, ×5, ×10.

When "Off" is selected, the full Voltage Display Range for Channel A is displayed over the height of the View.

When "×1" is selected, initially the full voltage range is displayed over the height of the view with a vertical scroll bar on the left of the view. You can use the scroll bar to move the data curve for Channel A up and down.

If you change the multiplier to "×N" which is greater than 1, then only 1/N of the full voltage range is displayed over the height of the view, with a vertical scrollbar on the left of the view. You can use the scroll bar to scroll over the full Voltage Display Range.

This parameter is applicable to all types of views in the Oscilloscope except Lissajous Pattern display. It should be noted that in "Channel A + Channel B" view, this parameter is for "Channel A + Channel B". Similarly, In "Channel A – Channel B" view, it is for "Channel A – Channel B".

2.3.5 View Type

There are four types of view in the Oscilloscope:

- **&** (Waveform display of Channel A and Channel B)

- **+** (Waveform display of Channel A + Channel B)

- **-** (Waveform display of Channel A - Channel B)

- **|** (Lissajous Pattern display for Channel A and Channel B)

You can select one of them for display.

2.3.6 Channel B Voltage Display Range

You can specify the Voltage Display range for Channel B. Available options are: Off, ±20 mv, ±50 mv, ±100 mv, ±200 mv, ±500 mv, ±1 v, ±2 v, ±5 v, ±10 v, ±20 v, ±50 v.

When "Off" is selected, the signal in Channel B will not be displayed in the Oscilloscope.

For single channel data, this control will be disabled.

This parameter is only applicable to two types of views: Channel A & Channel B and Lissajous Pattern. It is disabled in other types of views.

2.3.7 Channel B Voltage Display Range Multiplier

The Voltage Display Range Multiplier for Channel B is the zooming factor for B axis. There are 5 options available: Off, ×1, ×2 , ×5, ×10.

When "Off" is selected, the full Voltage Display Range for Channel B is displayed over the height of the View.

When "×1" is selected, initially the full voltage range is displayed over the height of the view with a vertical scroll bar on the right of the view. You can use the scroll bar to move the data curve for Channel B up and down.

If you change the multiplier to "×N" which is greater than 1, then only 1/N of the full voltage range is displayed over the height of the view, with a vertical scrollbar on the right of the view. You can use the scroll bar to scroll over the full Voltage Display Range.

This parameter is only applicable to one types of view: Channel A & Channel B. It is disabled in other types of views.

2.4 Markers

Maximum two markers can be placed in the plot region in a view.

Tapping anywhere within the plot region will place a marker on the screen at the position of tapping. By default, the marker is for left vertical axis. Tapping on the title of right vertical axis and then tapping in the plot region place a marker for the right vertical axis while tapping on the title of left vertical axis and then tapping in the plot region place a marker for the left vertical axis. No marker will be placed if there is no corresponding vertical axis.

The first marker is placed when **CAP** key on the keyboard is in off state. Otherwise, the second marker is placed instead.

Tapping anywhere outside the plot region and the vertical axis title area in the view will remove all markers placed previously.

The horizontal and vertical readings of a marker reader will be displayed on the top region of the view. If two markers are placed, the reading difference between the two markers will be displayed instead.

2.5 Maximum, Minimum, Mean and RMS Values

The Oscilloscope will display the maximum, minimum, mean and RMS value of each frame of data. You can toggle to see all these values by tapping on the displayed texts. The mean value is the DC voltage and the RMS value is the AC voltage during the scan time. In this regard, the Oscilloscope is also a voltmeter.

2.6 Trigger Event Marker

Two markers will be displayed in the Oscilloscope view to reflect the trigger parameters. One marker will be displayed on the left vertical axis to reflect the current Trigger Level (by the location of the marker on the vertical axis), Trigger Edge (by the arrow direction of the marker) and Trigger Source (by the color of the marker). The other marker will be displayed on the horizontal axis on the top to reflect the Trigger Delay (by the location of the marker on the horizontal axis) as well as the Trigger Source (by the color of the marker). Only negative Trigger Delay can be displayed. Trigger event can be found at the intercept of the two markers.

These markers are displayed only in one type of view: waveform display of Channel A and Channel B.

3 Spectrum Analyzer
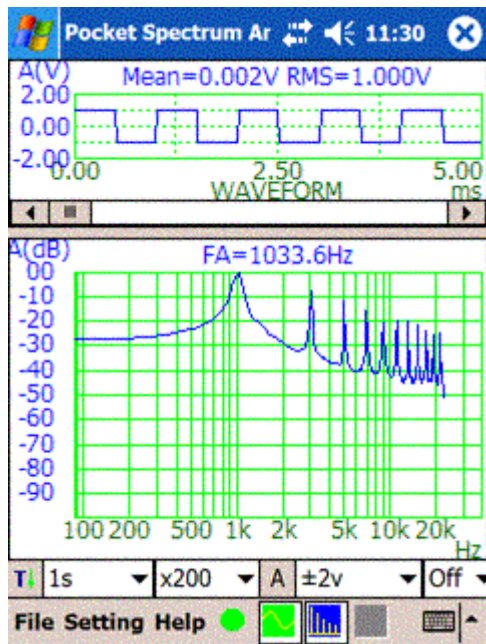
3.1 Spectrum Analyzer View Parameters

View parameters determine how the collected data are analyzed and displayed.

Tapping [Setting]>[Spectrum Analyzer Parameters] will show or hide the Spectrum Analyzer Parameters Toolbar. This toolbar contains two parts. Tapping on "F" on the first part or "B" on the Second Part will hide itself and bring up the other one. Tapping any place inside the Spectrum Analyzer view will bring up the Spectrum Analyzer Parameters Toolbar.

3.2 View Type

View Type Selection is located at the end of the second part of the Spectrum Analyzer Parameters toolbar.

There are four types of views in the Spectrum Analyzer:

- Amplitude Spectrum (AMS)
- Phase Spectrum (PHS)
- Auto-Correlation (ACR)
- Cross-Correlation (CCR)

You can select one of them for display.

3.3 View Parameters for Amplitude Spectrum Display

On the Spectrum Analyzer Parameters Toolbar, the adjustable parameters from left to right are:

3.3.1 Frequency Range (F)

10 options are available for Frequency Range (F). They are: 100 kHz, 50 kHz, 20 kHz, 10 kHz, 5 kHz, 2 kHz, 1 kHz, 500 Hz, 200 Hz, 100 Hz.

This parameter is initially selected by the software such that the selected Frequency Range is able to accommodate 0 to ½ of the sampling frequency. You can subsequently change the Frequency Range if necessary.

An important principle in digital signal processing is the "Nyquist Sampling Theorem" which states that any signal can be represented if sampled at least twice the rate of the highest frequency of interest. This means that if you wish to measure a 3,000 Hz signal, the sampling rate must be greater than 6,000 Hz, otherwise aliasing will occur. The possible range of sampling rates are limited by the capability of the sound device.

In Amplitude Spectrum Display, the horizontal axis can be displayed either in linear or logarithmic scale.

3.3.2 Frequency Range Multiplier

The Frequency Range Multiplier is the zooming factor for horizontal axis. There are 10 options available: ×1, ×2, ×5, ×10, ×20, ×50, ×100, ×200, ×500, ×1000.

When "×1" is selected, the full Frequency Range is displayed over the width of the view.

If you change the Frequency Multiplier to "×N" which is greater than 1, then only 1/N of the full Frequency Range is displayed over the width of the view, with a horizontal scrollbar at the bottom which allows you to scroll over the full range of the Frequency.

3.3.3 Channel A Voltage Display Range

In Amplitude Spectrum Display, there are two display modes for vertical axis:

1. Absolute Display Mode (RMS Amplitude)

   The vertical axis is scaled in absolute value. All data points are plotted based on the absolute values.

   You can specify the Voltage Display Range for Channel A. Available options are: Off, ±20 mv, ±50 mv, ±100 mv, ±200 mv, ±500 mv, ±1 v, ±2 v, ±5 v, ±10 v, ±20 v, ±50 v.

   When "Off" is selected, the data in Channel A will not be displayed.

2. Relative Display Mode

   The vertical axis is scaled in relative value. All data points are plotted based on the relative value with regard to the maximum value in the measurement. In this mode, the vertical axis ranges from 0 to 1 where 1 corresponds to the highest absolute vertical value in measurement.

   When "Off" is selected, the data in Channel A will not be displayed.

For each of the above display mode, the vertical axis can be displayed either in linear or logarithmic scale.

3.3.4 Channel A Voltage Display Range Multiplier

The Voltage Display Range Multiplier for Channel A is the zooming factor for A axis. There are 5 options available: Off, ×1, ×2, ×5, ×10.

When "Off" is selected, the full Voltage Display Range for Channel A is displayed over the height of the View.

When "×1" is selected, initially the full voltage range is displayed over the height of the view with a vertical scroll bar on the left of the view. You can use the scroll bar to move the data curve for Channel A up and down.

If you change the multiplier to "×N" which is greater than 1, then only 1/N of the full voltage range is displayed over the height of the view, with a vertical scrollbar on the left of the view. You can use the scroll bar to scroll over the full Voltage Display Range.

3.3.5 Channel B Voltage Display Range

1. Absolute Display Mode (RMS Amplitude)

You can specify the Voltage Display range for Channel B. Available options are: Off, ±20 mv, ±50 mv, ±100 mv, ±200 mv, ±500 mv, ±1 v, ±2 v, ±5 v, ±10 v, ±20 v, ±50 v. When "Off" is selected, the data in Channel B will not be displayed.

2. Relative Display Mode

The vertical axis is scaled in relative value. All data points are plotted based on the relative value with regard to the maximum value in the measurement. In this mode, the vertical axis ranges from 0 to 1 where 1 corresponds to the highest absolute vertical value in measurement. When "Off" is selected, the data in Channel B will not be displayed.

For each of the above display mode, the vertical axis can be displayed either in linear or logarithmic scale. For single channel measurement, this control will be disabled.

3.3.6 Channel B Voltage Display Range Multiplier

The Voltage Display Range Multiplier for Channel B is the zooming factor for B axis. There are 5 options available: Off, ×1, ×2, ×5, ×10.

When "Off" is selected, the full Voltage Display Range for Channel B is displayed over the height of the View.

When "×1" is selected, initially the full voltage range is displayed over the height of the view with a vertical scroll bar on the right of the view. You can use the scroll bar to move the data curve for Channel B up and down.

If you change the multiplier to "×N" which is greater than 1, then only 1/N of the full voltage range is displayed over the height of the view, with a vertical scrollbar on the right of the view. You can use the scroll bar to scroll over the full Voltage Display Range.

For single channel measurement, this control will be disabled.

3.3.7 FFT Points

This parameter is applicable to all types of views in the Spectrum Analyzer. 9 options are available: 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768.

The selected FFT size directly affects the resolution of the resulting spectra. The number of spectral points is always 1/2 of the selected FFT size. Thus a 1024 point FFT produces 512 output spectral points.

The frequency resolution of each spectral point is equal to the Sampling Frequency divided by the FFT size. For instance, if the FFT size is 1024 and the Sampling Frequency is 44100 Hz, the resolution of each spectral point will be:

44100 / 1024 = 43.07 Hz

Larger FFT size provides higher spectral resolution but take longer time to compute.

If the FFT size is greater than the number of data points per scan, then zero will be added at the end of the actual measurement data during FFT computation.

If the FFT size is less than the number of data points per scan, then the measurement data will be split into different segments with the size of each segment equal to the FFT size. The last segment of data will be dropped if its size is not equal to the FFT size. The final result will be obtained by averaging the FFT results from all segments. It should be noted that this approach is used for Amplitude Spectrum Display, Auto Correlation Display and Cross Correlation Display except Phase Spectrum Display where only the first segment of data is used.

You can adjust the number of data points per scan before sampling such that it equals to a multiple of the FFT size.

3.3.8 Windowing

Five windowing functions are supported: Rectangle, Triangle, Hanning, Hamming, Blackman.

Rectangle window is used by default. It should be noted that except Rectangle window, the rest of windowing functions are not applicable to Phase Spectrum Display, Auto Correlation Display and Cross Correlation Display.

3.4 View Parameters for Phase Spectrum Display

On the Spectrum Analyzer Parameters Toolbar, the adjustable parameters from left to right are:

3.4.1 Frequency Range (F)

Same as Amplitude Spectrum Display.

3.4.2 Frequency Range Multiplier

Same as Amplitude Spectrum Display.

3.4.3 Channel A Phase Display Range

Only two options available: Off, ±180D (i.e. ± 180 degree). When "Off" is selected, the data in Channel A will not be displayed.

3.4.4 Channel A Phase Display Range Multiplier

Same as Amplitude Spectrum Display.

3.4.5 Channel B Phase Display Range

Only two options available: Off, ±180D (i.e. ± 180 degree). When "Off" is selected, the data in Channel B will not be displayed.

3.4.6 Channel B Phase Display Range Multiplier

Same as Amplitude Spectrum Display.

3.47 FFT Points

Same as Amplitude Spectrum Display.

3.4.8 Windowing

Disabled.

3.5 View Parameters for Auto Correlation Display

On the Spectrum Analyzer Parameters Toolbar, the adjustable parameters from left to right are:

3.5.1 Time Delay Range (T)

This parameter is only applicable to Auto or Cross Correlation Display. 21 options are available. They are ±100 μs, ±200 μs, ±500 μs, ±1 ms, ±2 ms, ±5 ms, ±10 ms, ±20 ms, ±50 ms, ±100 ms, ±200 ms, ±500 ms, ±1 s, ±2 s, ±5 s, ±10 s, ±20 s, ±50 s, ±100 s, ±200 s, ±500 s.

Auto correlation and cross correlation is calculated using FFT. The computable Range for the Time Delay for a frame of data is thus $\pm 0.5 \times$ FFT Points / Sampling Frequency. Initially, the software will selected a Time Delay Range such that it is able to accommodate the range determined by the above formula. You can subsequently change the Time Delay Range if necessary.

3.5.2 Time Delay Range Multiplier

Same as Amplitude Spectrum Display.

3.5.3 Channel A Correlation Coefficient Display Range

Only two options available: Off, ±1. When "Off" is selected, the data in Channel A will not be displayed.

3.5.4 Channel A Correlation Coefficient Display Range Multiplier

Same as Amplitude Spectrum Display.

3.5.5 Channel B Correlation Coefficient Display Range

Only two options available: Off, ±1. When "Off" is selected, the data in Channel B will not be displayed.

3.5.6 Channel B Correlation Coefficient Display Range Multiplier

Same as Amplitude Spectrum Display.

3.5.7 FFT Points

Same as Amplitude Spectrum Display.

3.5.8 Windowing

Disabled.

3.6 View Parameters for Cross Correlation Display

On the Spectrum Analyzer Parameters Toolbar, the adjustable parameters from left to right are:

3.6.1 Time Delay Range (T)

Same as Auto Correlation Display.

3.6.2 Time Delay Range Multiplier

Same as Auto Correlation Display.

3.6.3 Channel A&B Correlation Coefficient Display Range

Same as Channel A Correlation Coefficient Display Range in Auto Correlation Display.

3.6.4 Channel A&B Correlation Coefficient Display Range Multiplier

Same as Amplitude Spectrum Display.

3.6.5 Channel B Correlation Coefficient Display Range

Not applicable and disabled.

3.6.6 Channel B Correlation Coefficient Display Range Multiplier

Not applicable and disabled.

3.6.7 FFT Points

Same as Amplitude Spectrum Display.

3.6.8 Windowing

Disabled.

3.7 Marker

Maximum two markers can be placed in the plot region in a view.

Tapping anywhere within the plot region will place a marker on the screen at the position of tapping. By default, the marker is for left vertical axis. Tapping on the title of right vertical axis and then tapping in the plot region place a marker for the right vertical axis while tapping on the title of left vertical axis and then tapping in the plot region place a marker for the left vertical axis. No marker will be placed if there is no corresponding vertical axis.

The first marker is placed when **CAP** key on the keyboard is in off state. Otherwise, the second marker is placed instead.

Tapping anywhere outside the plot region and the vertical axis title area in the view will remove all markers placed previously.

The horizontal and vertical readings of a marker will be displayed on the top region of the view. If two markers are placed, the reading difference between the two markers will be displayed instead.

3.8 Frequency and Cross Correlation Peak Location

The Spectrum Analyzer will display the Frequency Peak of each frame of data in the Amplitude Spectrum Display.

It will display Cross Correlation Peak Location as well as the corresponding peak value in the Cross Correlation Display.

4. Signal Generator
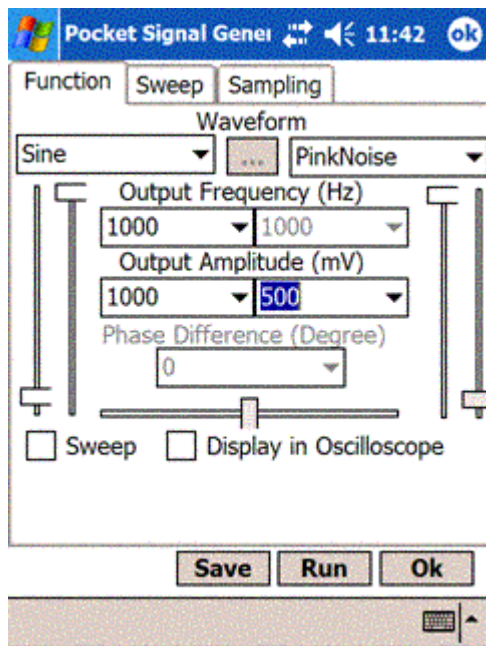
4.1 Output Sampling Parameters

Tapping [Setting]>[Signal Generator] will bring up the Signal Generator panel. The Output Sampling Parameters are located in the "Sampling" page of the panel.

The sampling capability is fully dependent on the sound device. Once the sampling parameters are specified and the Run button is tapped, it will attempt to start outputting using the specified sampling parameters. An error message will pop up if the specified sampling parameters are not supported by the sound device.

4.1.1 Sampling Frequency

The following sampling frequencies can be selected: 11025 Hz, 22050 Hz, 44100 Hz, 48000 Hz, 96000 Hz.

4.1.2 Sampling Channels

Two options are available:

- A

  Only Channel A is sampled. For stereo sound device, it will output the same signal for both channels.

- A&B

  Both Channel A and Channel B are sampled. Therefore, different signals can be generated at different channels.

4.1.3 Sampling Resolution

Two options are available: 8 Bit, 16 Bit.

4.2 Output Signal Parameters

Tapping [Setting]>[Signal Generator] will bring up the Signal Generator panel. The Output Signal Parameters are located in the "Function" page of the panel.

Each channel has its own output signal parameters.

4.2.1 Output Signal Waveform

There are 9 options available.

- **None**

  No signal will be generated for this channel, i.e. the output will be zero. No output frequency and output amplitude need to be specified.

- **Sine**

  Sinusoid waveform will be generated at this channel. Note that the initial phase of the generated signal is 0 degree.

- **Square**

  Square waveform will be generated at this channel. Note that the generated signal starts from the leading (up) edge of the square.

- **Triangle**

  Triangle waveform will be generated at this channel. Note that the generated signal starts from the middle of the upward-going edge of the triangle.

- **Saw Tooth**

  Saw Tooth waveform will be generator at this channel. Note that the generated signal starts from the middle of the upward-going edge of the saw tooth.

- **White Noise**

  White Noise will be generated at this channel. White noise has an equal amount of energy per Hz of bandwidth. No output frequency needs to be specified.

- **Pink Noise**

  Pink Noise will be generated at this channel. Pink noise has an equal amount of energy per octave of bandwidth. No output frequency needs to be specified.

- **MultiTones**

  If MultiTones is selected, the MultiTones Configuration dialog will popup, allowing you to add together signals with different waveforms, frequencies and amplitudes. You can add as much as 32 tones for each channel. The available waveform options are: Sine, Square, Triangle, Saw Tooth, White Noise, Pink Noise

The available options for Frequency are: 90000Hz, 50000Hz, 20000Hz, 10000Hz, 5000Hz, 2000Hz, 1000Hz, 500Hz, 200Hz, 100Hz, 50Hz.

Alternatively, you can key in any value that is less than or equal to half of the output Sampling Frequency specified in the main window.

The frequency selected or keyed in must be greater than or equal to 1 Hz and less than or equal to half of the Output Sampling Frequency specified. Otherwise an error message will pop up. As the output frequency for each tone has already been specified in the configuration, no output frequency needs to be specified in the main window.

Relative Amplitude is used as the weighting factor when different waveforms are added together. However, it has no impact on the absolute Output Amplitude. The absolute Output Amplitude is specified in the main window. It refers to the maximum value of the resulting waveform of the multitones.

You can add a tone into the multitone configuration for each channel by tapping ">" button and you can remove a tone from the multitone configuration by tapping "<" button. The multitone configuration can be saved and reloaded. The default extension for multitone configuration file is .tcf.

You can change or review the multitone configuration by tapping on the "..." button in the main window. It will bring up the Multitones Configuration Window.

When the "Sweep" check box in the "Function" page is ticked, a multi-tone waveform can be generated at a frequency that sweeps linearly or logarithmically within specified frequency range and time duration. Under that circumstance, the frequencies specified in the multitone configuration will be ignored and the Start Frequency and End Frequency specified in the main window will be used instead.

- **Waveform Library (WFLibrary)**

If WFLibrary is selected, a dialog window will popup, asking you to select a Waveform Library file (*.wfl) or any file that conforms to the format of a Waveform Library file.

The Waveform Library file is a simple Comma Separated Variable text file with the following format:

0,0,0

1,0.006135885,0.006135885

2,0.012271538,0.012271538

……

1022,-0.012271645,-0.012271645

1023,-0.006135992,-0.006135992

……

Each row contains three variables: sequential number, value for Channel A, value for Channel B. Minimum 2 points must be specified per waveform and there is no upper limit. There is no restriction on the value range as the relative value of the waveform is

used inside the software. However, for easy understanding purpose, it is recommended to use values between –1 and 1.

You can use Microsoft EXCEL, Notepad or other third party software to composite a Waveform Library file. One advantage of using Microsoft EXCEL is that you can make use of the EXCEL charting function to have a preview on your customized Waveform data. There is no restriction on the file extension to be used either. However, it is recommended to use .wfl as the file extension.

Waveform libraries provide great flexibility to the Signal Generator. Any arbitrary function can thus be generated by constructing a corresponding waveform library.

An arbitrary waveform can be generated at either a fixed frequency or a frequency that sweeps linearly or logarithmically within specified frequency range and time duration.

You can change the waveform library by tapping on the "..." button in the main window. It will bring up the "Open File" Window.

Some sample WFL files are provided in the WFLib folder together with the software.

4.2.2 Output Frequency

The available options are: 40000 Hz, 30000 Hz, 20000 Hz, 10000 Hz, 5000 Hz, 2000 Hz, 1000 Hz, 500Hz, 200Hz, 100Hz, 50Hz.

If you can not found the output frequency you want from the above options, you can key in the value you want directly. You can also use the left most vertical scroll bar (for Channel A) or the right most vertical scroll bar (for Channel B) to adjust the value of the output frequency.

It should be noted that the software will not allow the fundamental frequency of an output signal to be greater than half of the sampling frequency selected.

The output frequency is not applicable and is disabled when the waveform is "None", "White Noise", "Pink Noise" or "Multitone", or when "Sweep" check box is ticked.

4.2.3 Output Amplitude

The available options are: 1000 mv, 500 mv, 200 mv, 100 mv, 50 mv.

If you can not found the output amplitude you want from the above options, you can key in the value you want directly. You can also use the vertical scroll bar to adjust the value of the output amplitude.

It should be noted that the software will not allow you to specify an output amplitude greater than the corresponding maximum voltage value configured during calibration.

Output Amplitude is disabled when the waveform is "None".

4.2.4 Output Phase Difference

You can specify the Output Phase Difference between the output signals in the two channels when their output frequencies are the same. This is only applicable to waveform "Sine", "Square", "Triangle", "Saw Tooth", "WFLibrary" in non-sweeping mode. For different waveforms, the phase difference is calculated with respect to the initial phase described in the waveform sections.

4.3 Sweep Parameters

Tapping [Setting]>[Signal Generator] will bring up the Signal Generator panel. The Output Signal Parameters are located in the "Sweep" page of the panel.

The waveform can be output at a frequency that sweeps linearly or logarithmically within specified frequency range and time duration.

4.3.1 Start Frequency

Each channel can have its own Start Frequency. You can key in a value between 1 Hz and half of the Output Sampling Frequency specified. You will be notified if the value is out of range.

4.3.2 End Frequency

Each channel can have its own End Frequency. You can key in a value from 1 Hz up to half of the Output Sampling Frequency specified. You will be notified if the value is out of range.

4.3.3 Sweep Mode

You can specify either linear or logarithmic sweep mode.

4.3.4 Sweep Duration

You can specify a sweep duration from 1 s to up to 2147483647 s.

4.4 Save Function

The output signal for a specified time duration can be saved as Wave File (*.wav) or Text File (*.txt). The wave file format follows the standard Wave File PCM format and can be replayed using third party software like Microsoft Windows Media Player. The Text File is a Comma Separated Variable file and has the following format:

- **One channel data format:**

  Data Points
  Sampling Frequency=44100 Hz
  Sampling Resolution=8 Bits
  Total Data Points=44100
  No., Time (S), Channel A (V)
  0, 0.000000, 0.000000
  1, 0.000023, 0.141732
  2, 0.000045, 0.275591
  3, 0.000068, 0.409449
  4, 0.000091, 0.535433
  5, 0.000113, 0.653543

Apart from the 5 header lines, each row will contain a sequential number, a time stamp (in second) and a value for Channel A (in Volt).

- **Two channel data format:**

Data Points
Sampling Frequency=44100 Hz
Sampling Resolution=16 Bits
Total Data Points=44100
No., Time (S), Channel A (V), Channel B (V)
0, 0.000000, 0.000000, 0.000000
1, 0.000023, 0.014197, 0.000000
2, 0.000045, 0.028111, 0.000000
3, 0.000068, 0.041453, 0.000000
4, 0.000091, 0.053954, 0.000000
5, 0.000113, 0.065361, 0.000000

Apart from the 5 header lines, each row will contain a sequential number, a time stamp (in second) and a value for Channel A (in Volt) and a value for Channel B (in Volt).

If the "Sweep" checkbox is ticked, the output signal for the sweep duration will be saved. Otherwise, a window will pop up when you tapping the "Save" button, asking you to specify a duration. You can then key in a duration in the range from 1 s to 1000 s.

A "Save as" window will then be displayed. You can select a file type and key in a file name for the file to be saved.

4.5 Run/Stop

Tapping the Run/Stop button will generate the signal. It toggles between Run and Stop if tapped.

5. Menu

File Setting Help

5.1 File SubMenu
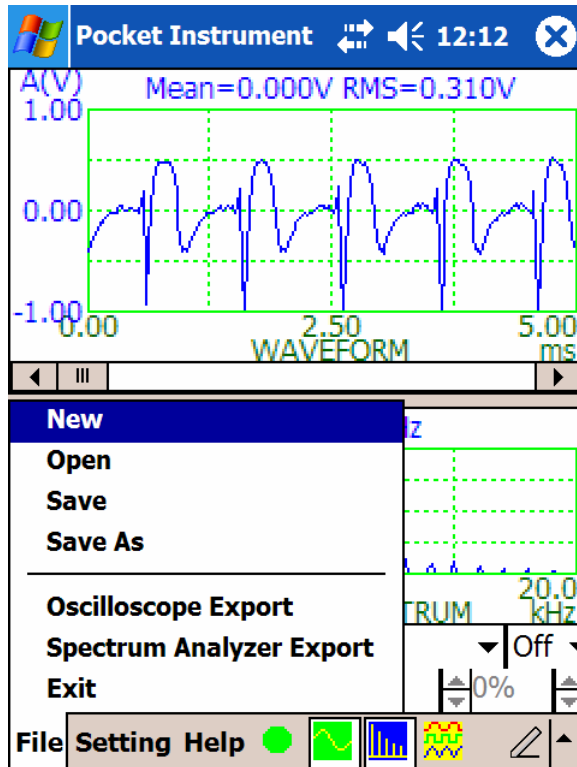
5.1.1 New

The command is used to create a new, blank document for measurement, with the system default panel setting fixed in the factory. The new document will be used to hold the latest collected frame of data.

5.1.2 Open

The command is used to open an existing document. Only standard WAV file in PCM format can be opened. An error message will pop up if the file format is not recognizable. WAV file with PCM format is widely supported by many softwares. You can use a third-party pocket PC software such as "Notes" provided in Windows Mobile to record data and then use VIRTINS Pocket Multi-Instrument to display and analyze the data. Only one document can be opened at a time.

5.1.3 Save

This command is used to save an opened document. If the document is new, then you will be prompted to give a file name for the document. This function is disabled when the document is empty.

5.1.4 Save As

This command is used to save an opened document with a specified new file name. This function is disabled when the document is empty.

5.1.5 Exit

This command is used to close the application. If the document content has been changed and the change has not yet been saved, a message box will pop up to ask whether you want to save the change or not.

5.1.6 Oscilloscope Export

This command is used to export the measured data as TXT file. When selected, a "Save As" window will pop up. The text file can be imported into third party software such as Microsoft Excel for further processing and analysis. This function is disabled when the document is empty.

5.17 Spectrum Analyzer Export

This command is used to export the calculated data (RMS Amplitude Spectrum, Phase Spectrum, Auto Correlation or Cross Correlation depending on the current view type) as TXT file. When selected, a "Save As" window will pop up. The text file can be imported into third party software such as Microsoft Excel for further processing and analysis. This command is disabled when the document is empty.

5.2 Setting SubMenu
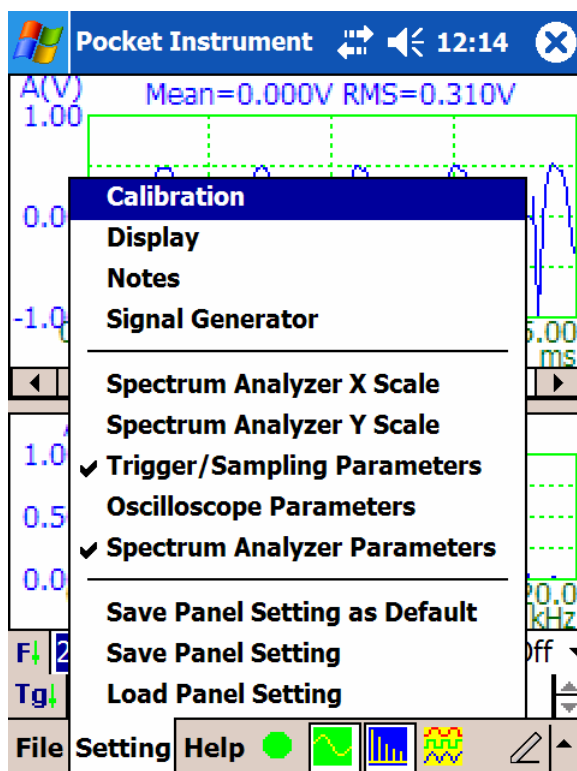
5.2.1 Calibration

You can calibrate the input signal for Oscilloscope and Spectrum Analyzer by assigning a Maximum Voltage Value for the 8 bit and 16 bit A/D conversion respectively. The default value is 1000 mV.

Similarly, You can calibrate the output signal for Signal Generator by assigning a Maximum Voltage Value for the 8 bit and 16 bit D/A conversion respectively. The default value is 1000 mV.

The functions of the buttons in the dialogue are as follows:

- Default: All parameters in this page will be filled with default values.

- Save: Save and Apply the change.

- OK: Apply the change without saving and close the dialogue.

- Cancel: Cancel the change and close the dialogue.

In a pocket PC, you can use some sort of "Volume Control" utility program provided under the OS to adjust the gain/volume of the sound input or output devices. Therefore the calibration setting is only valid when you use the same volume setting during both calibration and actual measurement. Automatic Gain Control (AGC) (if any), Bass Boost (if any), Treble Adjustment (if any) and so forth, must be disabled to ensure that no artificial modification on the input and output signal.

5.2.2 Display

In Oscilloscope and Spectrum Analyzer, the following display parameters are configurable:

- Background Color

- Color of data curve for Channel A

- Color of data curve for Channel B

- Grid Color

- Other Text Color, such as the color for notes and T or F axis label, etc.

Tapping on the color box will bring up a color selection window which allows you to select the color you want.

There are two ways to display a frame of data:

- Display all data points

  In this mode, all data points will be plotted on the screen. When the total number of data points are greater than the total number of the horizontal pixels of the plot region, multiple points may be plotted per horizontal pixel. For example, if the total number of

data points per scan is 10000 and the horizontal length of the plot region is 1000 pixels, then 10 points will be plotted per horizontal pixel.

The advantage of this display mode is that you are able to see all peaks in the data. However, the screen refresh becomes slow and the data curve becomes clustered when the total number of data points is large.

- Display one data point per vertical raster line

  In this mode, one data point is plotted per horizontal pixel (vertical raster line). The vertical value of the data point is interpolated from the collected raw data. The advantage of this display mode is that the screen refreshes very fast even if the total number of data points per scan is very large. The disadvantage is that it might miss out the some characteristics of the data such as peak values.

It should be noted that the data analysis (e.g. Spectrum Analysis, etc) is based on all the collected data points and is not affected by the above display modes.

It should also be noted that Lissajous Pattern View will always display all collected data points irrespective of the display mode setting.

The software has a display mode automatic switching feature. In "Display one data point per vertical raster line" mode, the software will force the display to "Display all data points" mode when the total number of data points in time domain is less than 2 times of the horizontal length of the plot region in Oscilloscope. In Spectrum Analyzer, the software will force the display to "Display all data points" mode when the total number of data points in frequency domain is less than 4 times of the horizontal length of the plot region. The threshold value in Spectrum Analyzer is higher because the signal in frequency domain tends to change more abruptly (thus more likely to miss out the peak value) than that in time domain. Note that the horizontal length of the plot region is increased by multiple times with the corresponding multiplier. Therefore, you are always able to see all data points if you zoom in sufficiently irrespective of the display mode you set.

Due to the above display mode automatic switching feature, it is recommended that the "Display one data point per vertical raster line mode" be used as the normal setting. You can switch to "Display all data points" mode manually when necessary.

- Invert input signal before performing any processing

If the check box "Invert input signal before performing any processing" is checked, the input signal will be inverted by the software just after A/D conversion, e.g. +1V will become -1V after the inversion. All the subsequent processing such as triggering, data analysis and display will be performed based on the inverted signal.

The check box is un-ticked by factory default.

- Remove DC component in spectrum analysis

Some of the sound devices may introduce a small background DC offset even thought the sound device is AC coupled. The DC offset results in one or a few frequency peaks around 0

Hz and sometimes these peaks can be higher than those frequency peaks of interest. Leaving this check box ticked will remove the DC component present in the input signal in spectrum analysis.

This check box is ticked by factory default.

- Enable Record Length change via "Point" in Sampling Parameter Toolbar

If this check box is ticked, it allows advanced user to change the Record Length directly. This is sometimes useful when you want the Record Length to be a multiple of the FFT size.

This check box is un-ticked by factory default.

- Auto-run oscilloscope at startup

If this check box is ticked, the Oscilloscope and Spectrum Analyzer will start running automatically upon the launching of the program.

The check box is ticked by factory default.

The functions of the buttons in this dialogue are as follows:

- Default: The parameters will be filled with default value.

- Save: Save and Apply the change.

- OK: Apply the change without saving and close the dialogue.

- Cancel: Cancel the change and close the dialogue.

5.2.3 Note
You can write down some notes for a measurement. The notes will be displayed if you tick the "Display" checkbox. The notes will persist in the WAV file if saved.

5.2.4 Signal Generator
Refer to the chapter of Signal Generator.

5.2.5 Spectrum Analyzer X Scale
The horizontal axis (X) can be set to either linear or logarithmic scale. This function can also be accessed by double tapping on the X axis of the spectrum analyzer when the oscilloscope/spectrum analyzer is not running.

5.2.6 Spectrum Analyzer Y Scale

There are two display modes for the vertical axis (Y): Absolute Display Mode (RMS Amplitude Spectrum) and Relative Display Mode. If the "Normalized" checkbox is ticked, Relative Display Mode is selected. Otherwise, Absolute Display Mode is selected. In both modes, the vertical axis can be set either to linear (Volt) or logarithmic (dB) scale. This function can also be accessed by double tapping on the Y axis of the spectrum analyzer when the oscilloscope/spectrum analyzer is not running.

5.2.7 Trigger/Sampling Parameters

Tapping this command will show or hide the Trigger/Sampling Parameters Toolbar.

5.2.8 Oscilloscope Parameters

Tapping this command will show or hide the Oscilloscope View Parameters Toolbar.

5.2.9 Spectrum Analyzer Parameters

Tapping this command will show or hide the Spectrum Analyzer View Parameters Toolbar.

5.2.10 Save Panel Setting as Default

When you start the software at the very first time, system default panel setting set in the factory will be loaded. You can subsequently change the panel setting to whatever you want, and then save the panel setting as default via this command. This default setting will be loaded at startup next time. You can always go back to the system default panel setting by clicking on "File"->"New" command.

The panel setting here includes the following parameters:

- Trigger Parameters

- Sampling Parameters

- Oscilloscope View Parameters

- Spectrum Analyzer View Parameters

- Signal Generator Parameters

5.2.11 Save Panel Setting

You can save the current panel setting into a Panel Setting File (*.psf) using this command. The saved panel setting can be loaded at later time. This will free you from re-adjusting the panel setting for a particular type of tests again and again.

5.2.12 Load Panel Setting

You can load a panel setting from a previously saved Panel Setting File (*.psf) using this command. This will free you from re-adjusting the panel setting for a particular type of tests again and again.

5.3 Help SubMenu
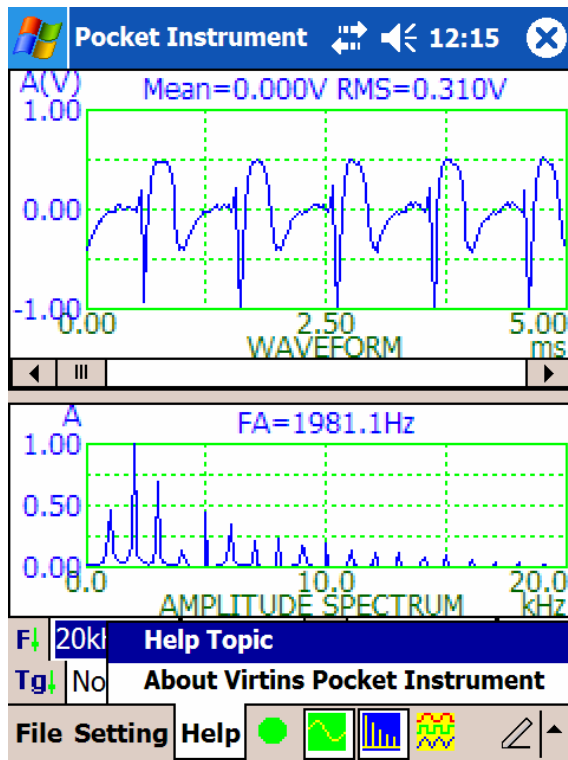
5.3.1 Help Topics

This command will open the Help window.

5.3.2 About Virtins Pocket Multi-Instrument

This command will open the About window which displays the software version and license information.

6. Instrument Toolbar

The Instrument Toolbar is located on the right hand side of the Menu Bar, it consists of four buttons:

- Run/Stop Oscilloscope/Spectrum Analyzer

  Tapping this button will run or stop the oscilloscope/spectrum analyzer.

- Oscilloscope

  Tapping this button will open/close the display of Oscilloscope. The Oscilloscope can not be closed if the Spectrum Analyzer has already been closed. If both Oscilloscope and Spectrum Analyzer are opened, the screen will be split into two panes, with the upper one being Oscilloscope and the lower one being Spectrum Analyzer. You can adjust the size of the panes by dragging the demarcation line between them.

- Spectrum Analyzer

  Tapping this button will open/close the display of Spectrum Analyzer. The Spectrum Analyzer can not be closed if the Oscilloscope button has already been closed. If both Oscilloscope and Spectrum Analyzer are opened, the screen will be split into two panes, with the upper one being Oscilloscope and the lower one being Spectrum Analyzer. You can adjust the size of the panes by dragging the demarcation line between them.

- Run/Stop Signal Generator

  Tapping this button will run or stop the Signal Generator. The settings of Signal Generator can be viewed and edited by tapping [Setting]>[Signal Generator].

7. FAQ

1. How to calibrate the input channel and output channel?

The simplest way is to use a multimeter. You need to calibrate the output channel first. The steps are as follows:

- Tap [Setting]>[Calibration], take note of the current output calibration factor A0

- Tap [Setting]>[Signal Generator], configure and generate a 1 kHz sine wave with an amplitude of A0

- Use a multimeter to measure the AC voltage (Vrms) in mV from the "Speaker/Earphone out" jack

- The new output calibration factor is then: A1=sqrt(2)*Vrms=1.414Vrms (mV)

- Tap [Setting]>[Calibration], enter A1 for the output calibration factor and tap "Save"

After calibrating the output channel, you can calibrate the input channel. The steps are as follows:

- Tap [Setting]>[Calibration], take note of the current input calibration factor B0

- Loop back "Speaker/Earphone out" to "Mic In" using an attenuation cable with an attenuation factor f , e.g. f=10

- Tap [Setting]>[Signal Generator], configure and generate a 1 kHz sine wave

- Run the Oscilloscope

- Adjust the output amplitude in the Signal Generator such that the measured signal in the Oscilloscope has an amplitude of B0, take note of the output amplitude value x (in mV) in the Signal Generator.

- The new input calibration factor is then: B1=x/f (mV)

- Tap [Setting]>[Calibration], enter B1 for the input calibration factor and tap "Save"

It should be noted that in a pocket PC, you can use some sort of "Volume Control" utility program provided under the OS to adjust the gain/volume of the sound input or output devices. Therefore the calibration setting is only valid when you use the same volume setting during both calibration and actual measurement. Automatic Gain Control (AGC) (if any), Bass Boost (if any), Treble Adjustment (if any) and so forth, must be disabled to ensure that no artificial modification on the input and output signal.

2. Are the data files of VIRTINS Pocket Multi-Instrument compatible with Virtins Sound Card Instrument?

Yes. Virtins Pocket Multi-Instrument is the pocket PC version of PC-based Virtins Sound Card Instrument with the same functionality. All data files including Waveform Library files (*.wfl), Tone Configuration files (*.tcf), WAV files (*.wav), etc, are compatible, except Panel Setting files (*.psf).

3. Can I use the Oscilloscope, Spectrum Analyzer and Signal Generator simultaneously?

Yes. You can use the Signal Generator to generate a signal to a device under test and observe the response from the device in the Oscilloscope and Spectrum Analyzer simultaneously.

A Run/Stop Signal Generator button is also provided in the main screen. When tapped, it will start signal output immediately without opening up the Signal Generator Setting dialog which will otherwise block the view of oscilloscope and spectrum analyzer.

4. I need to create 2 types of waveforms and was wondering if your software does it. The first is a 10 ms burst of 4 kHz followed by 990 ms of silence, and the second is a 1 ms burst of 4 kHz followed by 999 ms of silence?

The Signal Generator supports arbitrary waveform generation and you can use any number of points to define a waveform of one period. The waveform definition data are stored in a Waveform Library file (*.wfl) which is simply a TXT file. Please refer to the relevant section of Signal Generator in this help document for the format of Waveform Library file.

Supposing an output sampling rate of 44100 Hz will be used, you can use 44100 points to define the waveform wanted in Microsoft Excel, and store it in a TXT file following the Waveform Library file format. Then, in the Signal Generator, load this file and generate it at a frequency of 1 Hz. If you want to specify a duration of the signal, you should sweep it from 1 Hz to 1 Hz with a specified duration.

5. When I generate a sweep signal for more than 1 second, the output signal does not seem to be continuous?

This might happen in some slow-speed pocket PC when the sweep duration is greater than 1 second. A workaround is to save the sweep signal in a WAV file first and then play the WAV file.

6. Can I see the generated signal in the Oscilloscope at real time?

Yes, you can. Just select "Display in Oscilloscope" option in the "Function" page of the Signal Generator before you press the "Run" button of the Signal Generator. The output signal will be loop back to the Oscilloscope and Spectrum Analyzer via software.

7. Can I use the Pocket Instrument to do spectrum and correlation analysis on those data that are not acquired from the sound device?

Yes. You can use the Pocket Instrument analyze and display any TXT data. At this moment, you can not import the TXT data directly to the Oscilloscope/Spectrum Analyzer. However, you can form a Waveform Library file using your TXT data and then generate a WAV file using the Signal Generator. The WAV file can be imported directly to the Oscilloscope/Spectrum Analyzer for display and analysis.

8. After power resume, the Oscilloscope sometime switches from the external microphone to the internal one automatically ?

This may happen in some brands of pocket PC, e.g. Dell Axim X50v, if power-off occurs when the Oscilloscope is still in running state. After power resume, just tap the Run/Stop button twice to stop and re-run the Oscilloscope.

9. Inability to display a square wave of 7 Hz, but a good shape is displayed for a square wave of 100 Hz?

This is due to the inherit limitation of the sound device in pocket PC. The sound device in pocket PC is AC-coupled. There is normally a capacitor at the input which blocks DC and low-frequency signal. The bandwidth of the sound device is normally from 20 Hz~20 kHz. Thus a 7 Hz signal may be deformed.

10. When I use a sampling frequency of 96 kHz to generate a 1 kHz sine wave signal, the output signal does not seem to be 1 kHz?

This will happen when your pocket PC does not support a sampling frequency of 96 kHz. Some pocket PCs do not return an error message when the sampling frequency requested exceeds its capability. Please check your pocket PC manual or OS settings to make sure your pocket PC supports a sampling frequency of 96 kHz before you can use it. A pocket PC normally supports a sampling frequency of up to 44.1 kHz.

11. When I use a sampling frequency of 96 kHz to monitor a 1 kHz sine wave signal, the spectrum analyzer does not show a frequency peak at 1 kHz?

This will happen when your pocket PC does not support a sampling frequency of 96 kHz. Some pocket PCs do not return an error message when the sampling frequency requested exceeds its capability. Please check your pocket PC manual or OS settings to make sure your pocket PC supports a sampling frequency of 96 kHz before you can use it. A pocket PC normally supports a sampling frequency of up to 44.1 kHz.