Readme – Accelerometer Impact Software

1. INSTALL THE SOFTWARE FIRST

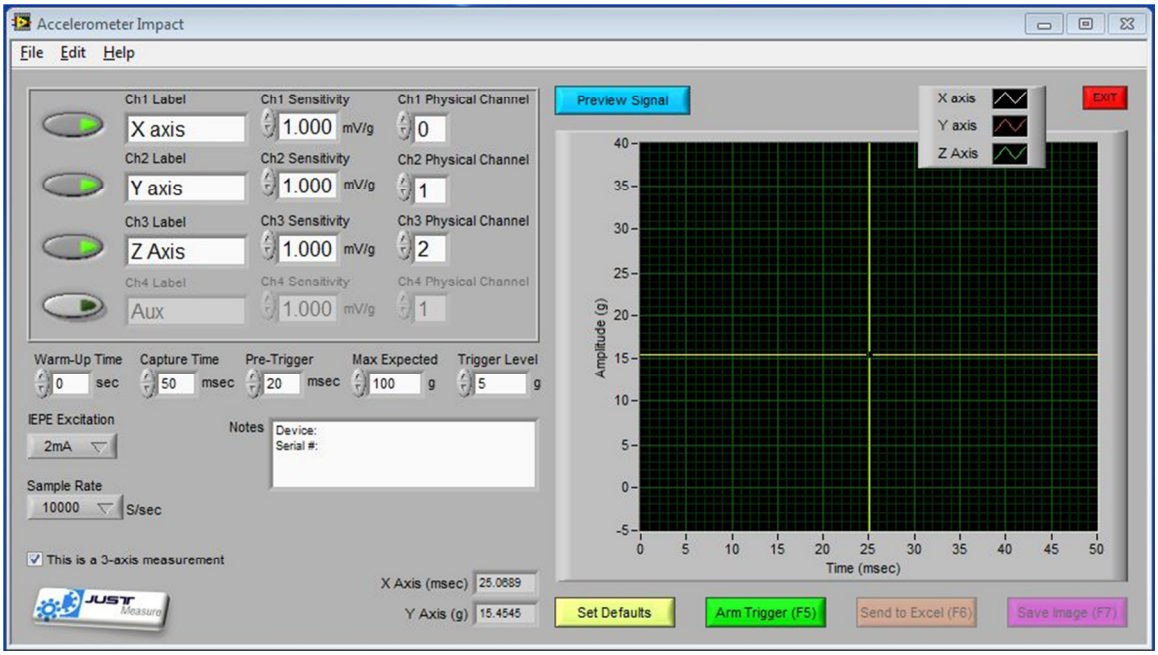
The software installs the necessary drivers for Microsoft Windows to recognize your National Instruments (NI) data acquisition device and any sound cards connected to the PC.

2. ACCELEROMETERS SUPPORTED

This software will work with any accelerometers with a mV/g output. One example is IEPE Accelerometers. IEPE accelerometers are also called ICP™, ISOTRON, CCLD, or Deltatron accelerometers. These are names that vary by manufacturer, but they all mean the same thing: electronics are built into the sensor and a DC excitation current from 2mA to 20mA is sent automatically along the cable from the instrument. This current powers the electronics inside the accelerometer. There are many instruments that provide this current, and the "precision suggestion" (section 4) will handle this automatically. The accelerometer should have a specification of "mV/g". Appropriate accelerometers for shock and impact testing will have sensitivities that vary from 0.1mV/g to 10mV/g, though this is just typical and certainly sensors much more and much less sensitive will also be compatible with this software application. If you're using a sound card, then the voltage input is being read and any signal conditioning required to interface to the sound card is acceptable.

3. SOFTWARE OPERATION:

Screenshot of the application:



"Ch(x) Label": This is used to create a header above each column of data in the resulting Excel file. These labels are also updated in the plot legend of the data on the right-hand side of the screen.

"Ch(x) Sensitivity": This is the calibrated sensitivity of the accelerometer and any gain stages in front (uncommon). You can typically find this on the calibration sheet with the paperwork provided along with the transducer. If you're using a sound card, the maximum input level of the sound card is represented at 1.00 and the minimum is -1.00. These fields become a multiplier.

"Ch(x) Physical Channel": This denotes the hardware channel on the data acquisition device that is connected to the accelerometer. For most devices supported by the software, these numbers have to be in increasing order or you could receive an error when the trigger is armed. **See table 2 and table 3 below for more information on which physical channel to select in this field.

NOTE: If you are using a sound card, you must only select as many channels as available or you will receive an error! The oval buttons in the upper left-hand corner allow you to select or de-select an available channel. For most sound cards, you cannot enable more than 2 channels at a time as most sound cards only have 1 or 2 input channels.

"Warm-up Time": This is only appropriate for NI devices with built-in excitation. Once the excitation is turned on by the software, this allows for a few seconds of settling time. Once you click "Arm Trigger", the IEPE will be turned on and the count-down will start before the trigger is actually armed and ready to take data.

"Capture Time": This denotes the time (in milliseconds) of the data capture. The minimum amount is 1 millisecond and the maximum is 1,000 in 1 millisecond increments.

"Pre-Trigger": This denotes the amount of time (in milliseconds) of the data capture that will precede the selected trigger level. This number is included in the "Capture time", and thus must be less than the capture time. For example: If you have selected 300 milliseconds for the capture time and 100 milliseconds for the pre-trigger, you should see the signal cross the trigger level you selected at 100 milliseconds on the graph, and the data will span from 0 to 300 milliseconds. The available values for this parameter are 0 to 500msec in 1msec increments.

"Max Expected": This value should exceed the maximum level you expect to see from your test on any channels. It is used to set the gain / range of the NI device, if applicable and ensure that no levels will be exceeded based on your accelerometer sensitivity settings and hardware capabilities

"Trigger Level": This represents the analog trigger level that will put data on the graph and export to Excel. There is no time limit to getting to that trigger level. The trigger will trip if any of the active channels exceeds the magnitude of the trigger in the positive or negative direction.

"Set Defaults": This sets all of the input parameters on the screen such that they are the same then next time you launch the application.

"Arm Trigger" (also activating by pressing F5 on the keyboard): This arms the hardware such that next time the trigger level is exceeded, the data will be captured and displayed on the screen. No data will be displayed, however, until the trigger condition is met

"IEPE Excitation": This allows you to choose from up to 4 options for the current level from the National Instruments Data Acquisition device. The options are 0, 2mA, 4mA, and 10mA. The only options that are selectable will be the ones available from within the device itself. If the device you're using does not support a level, it will be grayed out. This does not control any ICP signal conditioner / power supply that is external to the National Instruments device. If you are using a sound card, IEPE excitation is not an option.

"Sample Rate": This is the sampling rate, per-channel, of the hardware. It has a few suggestions, but allows you to key any rate compatible with your hardware or sound card.

4. SUGGESTIONS FOR NATIONAL INSTRUMENTS HARDWARE

Precision Suggestion: The National Instruments PCI-4462:

- Plugs inside a desktop PC into the "PCI slot" (in almost all desktop computers)
- Built in IEPE power to produce the DC excitation current so that you can hook it directly up to the accelerometer
- Features BNC jacks on the front for simple connection to the accelerometers
- 118dB of dynamic range from 24-bit A/D converters for very fine resolution even with large signals like those produced on a drop test
- 6 gains built into device to zoom in on small pulses
- See the user's manual of this device at sine.ni.com/manuals for more information on measurement accuracy.

Low Cost Suggestion: The National Instruments USB-9215A (USB):

- Plugs into any USB port of a laptop or desktop and does not require batteries or a separate power cord
- Features BNC jacks on the front for simple connection to accelerometers
- 16-bit A/D converter with no gain options
- See the user's manual of this device at sine.ni.com/manuals for more information on measurement accuracy
- Requires an extra device to supply the DC current to the sensor: suggested model 5108 from Kistler http://www.kistler.com) and a few extra cables (all 3 meter cables included in this low-cost suggestion when purchased from our website)

5. ALL HARDWARE OPTIONS

The software only works with National Instruments devices and sound cards, but there are many options in addition to the above suggestions. You might already have the National Instruments equipment you need. This software automatically detects and configures 14 Data Acquisition devices. All of the options are listed in Table 1 below. All of these devices have A/D converters on each channel that acquire data from each sensor simultaneously. Many National Instruments devices (not listed in this document) have a single A/D converter and scan through the channels, which would inappropriate for this application without some data processing due to the channel-to-channel delay. JustMeasure, LLC can customize this application to meet your needs: http://www.justmeasure.net

Table 1: All National Instruments Data Acquisition Devices Supported

Device	# of Inputs	Accuracy (g)[a]	Excitation Current?	Example NI Cable	Example NI Connector Box
PCI-6110	4	0.071	N	SH68-68-EP	SCB-68
PCI-6115	4	0.078	N	SH68-68-EP	SCB-68
PCI-6120	4	0.068	N	SH68-68-EP	SCB-68
PCI-6122	4	0.15	N	SH68-68-EP	SCB-68
PCI-6123	8	0.15	N	SH68-68-EP	SCB-68
PCI-6132	4	0.15	N	SH68-68-EP	SCB-68
PCI-6133	8	0.15	N	SH68-68-EP	SCB-68
PCI-6143	8	0.72	N	SHC68-68-EP	SCB-68
PCI-4462	4	0.20	Y	N/A	Built onto device
PCI-4472	8	23	Y	N/A	Built onto device
PCI-4474	4	23	Y	N/A	Built onto device
USB-9215A	4	28	N	N/A	Screw terminals
USB-9215A (BNC)	4	28	N	N/A	Built onto device
USB-9233	4	35	Y	N/A	Built onto device

[a]The accuracy calculated is theoretical worst-case scenario based on an ideal 5mV/g accelerometer and the National Instruments device at its maximum gain setting. This calculation is for the National Instruments device only and does not factor in the error from other sources including the sensor or cabling or external EMI/RF sources.

6. EXCITATION CURRENT TO THE ACCELEROMETER

The column in Table 1 (above) labeled "Excitation Current?" indicates whether or not the NI Device supplies the constant current of 2mA, 4mA, or 10mA to the accelerometer automatically. If the device is capable, it may not have all 3 options. It might only have 1 or 2. If it has none or if the level is inadequate, you have to supply a separate device that provides the excitation current. The Model 5108 from Kistler (included in the low-cost suggestion) is the recommended device. It passes the signal through to the National Instruments device via BNC connector outputs. It also has BNC inputs also allowing for easy cabling to the accelerometer.

7. PROPER CABLES / WIRING FOR THE NI DEVICES:

The devices with built-in excitation are special purpose devices primarily dynamic piezoelectric sensors. Consequently, they have built-in BMC or SMB connectors that can match the cable supplied by your accelerometer manufacturer.

The PCI devices (for desktop PC's in Table 1) without built-in current excitation have 68 pins for connecting signals, but you obviously don't need 68 connections just for the accelerometer. You'll order a cable from National Instruments that matches that device and a connector box with the screw terminals inside (see suggestions for these items in Table 1). The USB-9215A is the exception because it has screw terminals built into the side of the device. In any cases, the screw terminals will be assigned numbers. The purpose of each pin isn't labeled on the connector box itself. Here's where to connect the output of the signal conditioner:

Table 2: Wire connections for PCI Devices with cable and connector box

Physical Channel	Signal	Ground
0	68	34
1	33	66
2	65	31
3	30	63
4*	28	61
5*	60	26
6*	25	58
7*	57	23

*only available on 8 channel devices

Table 3: Wire connections for the USB-9215 Device

Physical Channel	Signal	Ground
0	0	1
1	2	3
2	4	5
3	6	7

The excitation device that we recommend (See section 6 above) has 3 BNC jacks for inputs and 3 BNC jacks for outputs. Consequently, you'll need 3 cables with a BNC jack on one side and 2 bare wires on the other side: one for "signal" and one for "ground". If you purchased a complete low-cost or precision bundle from JustMeasure, LLC these cables are provided standard by us. If you would rather build it yourself, you can connect the center pin of the BNC connector to the "Signal" terminal and the outer sheath (or ground) to the "ground" terminal listed in Table 2 above.

Still confusing? E-mail us at support@justmeasure.net and we'll try to explain it better for your particular device. Just let us know which one you're using!

8. PC REQUIREMENTS:

Software:

- Windows 2000/XP or later
- Microsoft Excel 2000 or later
- Adobe Acrobat Reader Ver. 6.0 or later

Hardware:

- 256MB RAM
- Pentium III / Celeron 600MHz or equivalent/faster

This document serves as a repository for all the technical information we've published about this application. If we've left something out or you need more information, all e-mail is answered within 24 hours:

Support@JustMeasure.net