



Readme – Blast Sound Level

1. INSTALL THE SOFTWARE FIRST

The software installs the necessary drivers for Microsoft Windows to recognize your National Instruments (NI) data acquisition device.

2. MICROPHONE TYPES SUPPORTED

If the microphone is specified in volts per Pascal (typically seen as mV/Pa) or mV/PSI, then it is compatible with this software. Any microphone is going to require some type of signal conditioning and/or power supply additional: this can be a separate voltage (sometimes up to 200V) or a DC offset current / voltage on the signal wire of the microphone. We recommend “ICP” or “IEPE” type microphones that have only 2 conductors in the wire: ground and a signal. The instrumentation or signal conditioning will provide a DC current ranging from 2mA to 20mA along the signal wire to power the microphone.

For very large blast levels, consider a “Piezoelectric Pressure Sensor”. They use the same IEPE type signal conditioning described above, and provide a more rugged solution for extremely blast noise levels exceeding 150dB or more. These are recommended on our website at <http://www.justmeasure.net>

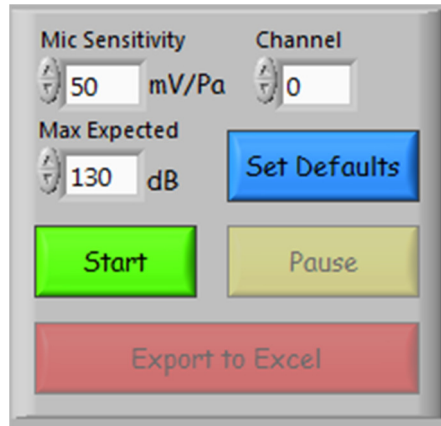
NOTE: The “low-cost” and “precision” options (listed below) include the proper signal conditioning. You just have to select the appropriate sensor depending on the expected decibel levels.

3. SENSOR PLACEMENT:

The blast could be indoors (like a firing range) or outside (like a free-field / ballistics blast). In either case, it is important that the placement and position of the sensor stay consistent between tests to compare test data. Additionally, the presence of a human body behind the microphone, for example, can cause acoustic reflections and effect results. The sensors recommended by JustMeasure (us) are very omnidirectional, but the orientation of the microphone is typically pointed towards the noise source or tilted 70 – 80° away from the sensors. Which way should your microphone point? JustMeasure would be happy to send you more data on the microphone and acoustic measurement – just e-mail us: support@justmeasure.net

4. OPERATION OF SOFTWARE

You can double click the “Blast Sound Level” link on your desktop or from Start Menu -> Programs -> JustMeasure. Once the software is launched, the next step is to provide a few parameters for the software to operate properly in this section:



“Mic Sensitivity”

You can input the sensitivity of the sensor (in mV/Pa), which will be providing on the calibration sheet from the manufacturer. If your microphone (or dynamic pressure sensor) is specified, in mV/PSI, simply divide the sensitivity value by 6,895 to arrive at mV/Pa for this software application.

Range: The software will accept 100mV/Pa (max) and 0.001mV/PA (min)

“Max Expected”

Input the maximum vibration levels you will need to measure in dB. If you don't know what kind of sound level to expect, try a test run using the maximum range of the microphone you've chosen. If this is a microphone, it'll be clearly listed. If it's listed as mV/PSI, you may not get a maximum dB level. Instead, you'll get a maximum PSI level. Here's the formula to convert to Decibels (dB):

$$\text{dB} = 20 * \log (x \text{ PSI} * 3.448 * 10^8)$$

Where “x PSI” can represent the maximum PSI level for your sensor and “dB” represents the maximum dB level to input into the “Max Expected” field of the software.

“Channel”

This specifies which hardware channel on the National Instruments devices is being utilized. For more information, see section 7 below on proper wiring of the sensor to the data acquisition device.

“Set Defaults”

This writes a small text file to your hard disk to permanently store your selections for the next time you run the software. For your convenience, you will not see any confirmation or response from hitting this button unless there are any problems or errors to report.

The next step in the software is to start the measurement. Controlling the measurement operation and analysis is done in this section of the software:

“Start”

This will start sampling the microphone or pressure sensor at 20,000 samples / sec, selecting the peak dB value every half second, and plotting that result on the graph. The graph will retain the most recent 30 seconds of data.

“Pause”

This will stop the sampling, but hold the most recent 30 seconds of data in memory. Note that once you “pause” you can’t re-start the sampling again.

“Export to Excel”

This will automatically open Microsoft Excel (required on your PC) and populate the data results with the date / time, and dB levels at each half second interval for the 30 seconds saved on the graph.

5. SUGGESTIONS FOR NATIONAL INSTRUMENTS HARDWARE

Precision Suggestion: The National Instruments USB-9233:

- Plugs into the USB port of a laptop or desktop PC – and no external power is required!
- Built in IEPE power to produce the DC excitation current so that you can hook it directly up to the microphone or pressure sensor
- Features BNC jacks on the front for simple connection to the sensor
- 108dB of dynamic range from 24-bit A/D converters to see background vibration levels even with large device vibration. This means you could record 50dB and 158dB, for example, on the same graph in the software.
- 6 gains built into device to zoom in on small blast noise levels (preset before the “start” button is hit automatically based on the sensitivity and max. expected inputs)
- 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-6210:

- Plugs into any USB port of a laptop or desktop and does not require batteries or a separate power cord
- Features small screw terminals on the sides
- 90dB of dynamic range from a single 16-bit A/D converter. This means you could record a background level of 50dB, for example, and still see 140dB blast noise levels.
- 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 excitation current to the microphone: suggested model 5114 from Kistler – <http://www.kistler.com>) and a few extra cables (all included in this low-cost suggestion when purchased from our website)
- See Section 7 below for the proper wiring configuration for the sensor, excitation device, and National instruments device

NOTE: If you purchase the low-cost or precision bundle from our website, all cables and the device that provides excitation current (if necessary) will be supplied to you by JustMeasure.

6. ALL NATIONAL INSTRUMENTS DEVICES SUPPORTED

Table 1: All National Instruments Data Acquisition Devices Supported

Device	# of Ch's	Resolution / Gains	Current Excitation?	Example NI Cable	Example NI Connector Box	Wire Connections
PCI (goes inside Desktop PC)						
PCI-4462	4	24-bit / 6	Y	N/A	Built into Device	Group D
PCI-4472	8	24-bit / 1	Y	N/A	Built into Device	Group D
PCI-4474	4	24-bit / 1	Y	N/A	Built into Device	Group D
PCI-6110	4	12-bit / 8	N	SH68-68-EP	SCB-68	Group M
PCI-6111	2	12-bit / 8	N	SH68-68-EP	SCB-68	Group M
PCI-6115	4	12-bit / 8	N	SH68-68-EP	SCB-68	Group M
PCI-6120	4	16-bit / 8	N	SH68-68-EP	SCB-68	Group M
PCI-6122	4	16-bit / 4	N	SH68-68-EP	SCB-68	Group M
PCI-6123	8	16-bit / 4	N	SH68-68-EP	SCB-68	Group M
PCI-6133	8	14-bit / 4	N	SH68-68-EP	SCB-68	Group M
PCI-6143	8	16-bit / 1	N	SH68-68-EP	SCB-68	Group M
PCI-6010 (37-pin)	8	16-bit / 3	N	SH37F-37M-1	CB-37F-LP	Group C
PCI-6220	8	16-bit / 4	N	RC68-68	CB-68LP	Group M
PCI-6221 (68-pin)	8	16-bit / 4	N	RC68-68	CB-68LP	Group M
PCI-6221 (37-pin)	8	16-bit / 4	N	SH37F-37M-1	CB-37F-LP	Group C
PCI-6250	8	16-bit / 7	N	SHC68-68-EPM	SCB-68	Group M
PCI-6251	8	16-bit / 7	N	SHC68-68-EPM	SCB-68	Group M
PCI-6280	8	18-bit / 7	N	SHC68-68-EPM	SCB-68	Group M
PCI-6281	8	18-bit / 7	N	SHC68-68-EPM	SCB-68	Group M
PCI-6224	16	16-bit / 4	N	RC68-68, qty 2	CB-68LPR, qty 2	Group M2
PCI-6229	16	16-bit / 4	N	RC68-68, qty 2	CB-68LPR, qty 2	Group M2
PCI-6254	16	16-bit / 7	N	SHC68-68-EPM & SHC68-68	SCB-68, qty 2	Group M2
PCI-6259	16	16-bit / 7	N	SHC68-68-EPM & SHC68-68	SCB-68, qty 2	Group M2
PCI-6284	16	18-bit / 7	N	SHC68-68-EPM & SHC68-68	SCB-68, qty 2	Group M2
PCI-6289	16	18-bit / 7	N	SHC68-68-EPM & SHC68-68	SCB-68, qty 2	Group M2
PCI-6225	40	16-bit / 4	N	RC68-68, qty 2	CB-68LP, qty 2	Group H
PCI-6255	40	16-bit / 7	N	RC68-68, qty 2	CB-68LP, qty 2	Group H
PCI-6013	8	16-bit / 4	N	R6868	CB-68LPR	Group M
PCI-6014	8	16-bit / 4	N	R6868	CB-68LPR	Group M
PCI-6023E	8	12-bit / 4	N	R6868	CB-68LPR	Group M
PCI-6024E	8	12-bit / 4	N	R6868	CB-68LPR	Group M

PCI-6036E	8	16-bit / 4	N	R6868	CB-68LPR	Group M
PCI-6030E	8	16-bit / 14	N	SH68-68-EP	SCB-68	Group M
PCI-6032E	8	16-bit / 14	N	SH68-68-EP	SCB-68	Group M
PCI-MIO-16XE-50	8	16-bit / 8	N	SH68-68-EP	SCB-68	Group M
PCI-6040E	8	12-bit / 15	N	R6868	CB-68LP	Group M
PCI-6052E	8	16-bit / 15	N	SH68-68-EP	CB-68LPR	Group M
PCI-6070E	8	12-bit / 15	N	SH68-68-EP	SCB-68	Group M
PCI-6031E	32	16-bit / 14	N	SH1006868	SCB-68, qty 2	Group H
PCI-6033E	32	16-bit / 14	N	SH1006868	SCB-68, qty 2	Group H
PCI-6071E	32	12-bit / 15	N	SH1006868	CB-68LP	Group H
PCMCIA Devices (for Laptop PC):						
DAQCard-6024E	8	12-bit / 4	N	RC68-68	CB-68LPR	Group M
DAQCard-6036E	8	16-bit / 4	N	RC68-68	CB-68LPR	Group M
DAQCard-6062E	8	12-bit / 4	N	RC68-68	CB-68LPR	Group M
USB-Powered Devices:						
USB-6210	8	16-bit / 4	N	None Required	Built into Device	Group U
USB-6211	8	16-bit / 4	N	None Required	Built into Device	Group U
USB-6221	8	16-bit / 4	N	None Required	Built into Device	Group UM
USB-6229	16	16-bit / 4	N	None Required	Built into Device	Group UM
USB-6251	8	16-bit / 7	N	None Required	Built into Device	Group UM
USB-6259	16	16-bit / 7	N	None Required	Built into Device	Group UM
USB-9215A	4	16-bit / 1	N	None Required	Built into Device	Group UQ
USB-9215A (USB)	4	16-bit / 1	N	None Required	Built into Device	Group D
USB-9233	4	24-bit / 1	Y	None Required	Built into Device	Group D

NOTE: For more information on the specific devices, visit <http://sine.ni.com/manuals> and type in the exact model from the first column of Table 1 (above) into the search field on that website.

7. CABLES / WIRING FOR NATIONAL INSTRUMENTS DEVICES

STEP 1: DETERMINE HOW EXCITATION IS PROVIDED

The column in Table 1 labeled “Excitation Current?” indicates whether or not the NI Device supplies the required current between 2mA and 20mA to the accelerometer automatically.

If “Y”: The excitation is provided automatically and only a single cable is required (typically provided by the accelerometer manufacturer) from the sensor direct to the National instruments device. The BNC or SMB connectors on the front of the National Instruments device are clearly marked with channel numbers and correspond to the channels in your JustMeasure software application.

If “N”: You have to supply a separate device that provides the excitation current. The Model 5114 from Kistler is the recommended device. This device is included in the low-cost bundle from the JustMeasure website. It has 2 BNC jacks: One for the sensor input and one for the output to the National Instruments device. The manufacturer of the accelerometer can provide the proper cable from the accelerometer to the “Sensor” input BNC jack. The “Output” BNC jack on this device will need a cable from the BNC jack to 2 bare wires: one for “signal”, and one for “ground”. The one exception is if you’ve purchased the USB-9215A, in which case you just need a cable with BNC plugs on both sides to connect the excitation device (model 480C02) to the National Instruments device.

NOTE: If you purchase the low-cost or precision bundle from our website, all cables and the device that provides excitation current (if necessary) will be supplied to you.

STEP 2: DETERMINE THE PROPER NI CABLE AND SCREW TERMINAL BOX

You will need a cable from National Instruments that matches that device and a screw terminal box with the screw terminals inside (see suggestions for each device in Table 1 above). The screw terminals in the connector box will be assigned numbers. These numbers DO NOT correspond to the “channel” input in the software!

STEP 3: DETERMINE WHICH SCREW TERMINALS TO USE

Use table 1 (above) to find the correct group for you your National Instruments device. Then, use Table 2 below to determine the appropriate screw terminals for the “signal” and “ground” wires coming out of the current excitation device.

NOTE: If your device is in Group D, you’ll only need the cable provided by the accelerometer manufacturer. The device has the current excitation source built-in to it, with the exception of the USB-9125 which still requires the external current excitation source between it and the accelerometer.

Table 2: Wire Connections for NI Devices

Group M		
Software 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

Group C		
Software Channel	Signal	Ground
0	1	20
1	21	2
2	22	4
3	5	23
4	6	25
5	26	7
6	27	9
7	28	10

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

Group U		
Software Channel	Signal	Ground
0	15	16
1	17	18
2	19	20
3	21	22
4	24	25
5	26	27
6	29	30
7	31	32

Group UQ		
Software Channel	Signal	Ground
0	0	1
1	2	3
2	4	5
3	6	7

Connector 1		
8	68	34
9	33	67
10	32	66
11	65	31
12	30	64
13	29	63
14	62	28
15	27	61
16	26	60
17	59	25
18	24	58
19	23	57
20	55	21
21	20	54
22	19	53
23	52	18
24	17	51
25	16	50
26	49	15
27	14	48
28	13	47
29	46	12
30	11	45
31	10	44
32	42	8
33	7	41
34	6	40
35	39	5
36	4	38
37	3	37
38	36	2
39	1	35

Group M2		
Software Channel	Signal	Ground
Connector 0		
0	68	34
1	33	66
2	65	31
3	30	63
4	28	61
5	60	26
6	25	58
7	57	23
Connector 1		
8	68	34
9	33	66
10	65	31
11	30	63
12	28	61
13	60	26
14	25	58
15	57	23

Group UM		
Software Channel	Signal	Ground
0	1	2
1	4	5
2	7	8
3	10	11
4	17	18
5	20	21
6	23	24
7	26	27
8	33	34
9	36	37
10	39	40
11	42	43
12	49	50
13	52	53
14	55	56
15	58	59

8. PC REQUIREMENTS:

Software:

- Windows 2000/XP/Vista
- Microsoft Excel 2000 or later
- Adobe Acrobat Reader v6 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:

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