

## Bump Testing

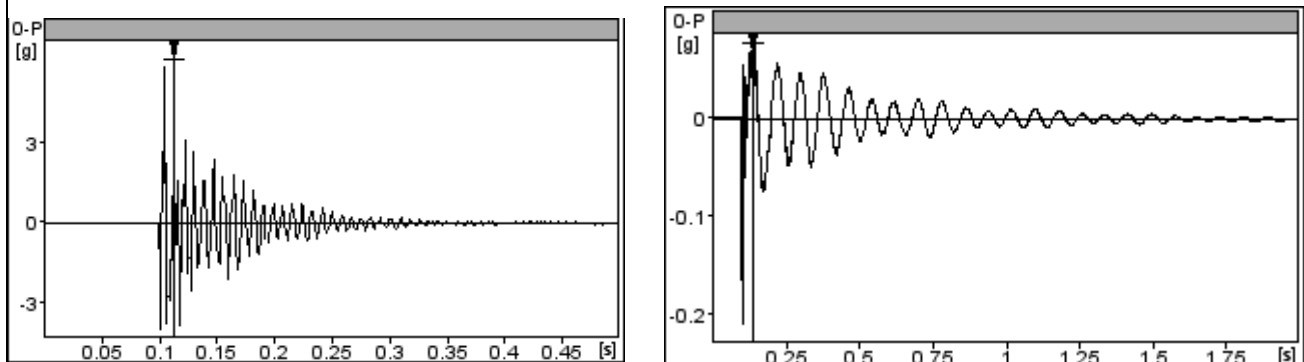
The VibXpert is extremely easy to use to bump test equipment or structures for resonant frequencies. To begin with, you don't have to set up a machine in the VXP to save your data to. You can save the data in a file, just as you would on your PC. When you upload the file to Omnitrend, you can drag and drop it to any point (measurement location). Personally, I like to attach a measurement location to each of my machines to store such data. It may be important, in some later investigation of rogue vibration on a machine to have the data already at your fingertips. One caution on this though, many things can change the frequencies at which machines or structures resonate, such as loose fasteners, repairs, and component replacements. If you have any doubt, retest. With the VXP it only takes a few minutes, and a change in the resonant frequencies can clue you in to know something significant has changed in the machine of interest.

It is recommended that sensor units are used (if using an accelerometer, use acceleration. If using a prox probe, use displacement and etc). The reason is to avoid any error that might be introduced by integration or differentiation of units. While it is true that acceleration units will accentuate the higher frequencies, and displacement units will accentuate the lower frequencies, this has to do with amplitude and not frequency. The bump test is primarily to show the "frequencies" at which equipment and structures naturally resonate.

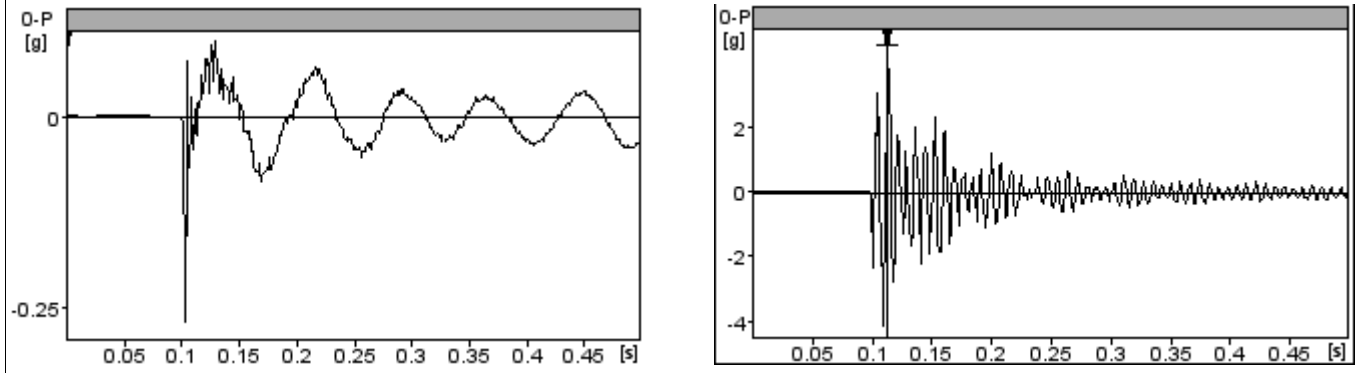
For maximum frequency accuracy, a pre-impact trigger with the Rectangular window should be used. For negative averaging, or for those who like to filter out the impact with a post-impact trigger, a Hanning window should be used, since the waveform will not begin at zero. This note will demonstrate an "at rest" (the machine is not running) procedure using the Rectangular window and a pre-trigger.

When using the Rectangular window for optimally accurate frequency placement, it is important that the waveform begin and end at zero. The Rectangular windowing function does not compensate for random beginning or ending of a waveform. So the ideal is to be able to see in the waveform that it started at zero and ended at zero. (see fig. 1)

Figure 1: Waveforms that show zero at both ends



The two waveforms shown above are examples of bumps done with different setups to achieve complete ringdown before being cut off. You see, on the left of the waveform, zero energy, then the impact and full ringdown. If the time of the waveform was too short, the waveform would be cut off before complete ringdown, as in the waveforms below (see fig. 2).



## Procedure

In the VibXpert, choose “Multimode” then go to the “Advanced” tab and scroll down to highlight the “Bump Test” icon. With this icon highlighted, there is an information window at the bottom of the page that shows the current task setup that is active for the bump test procedure, the device should be connected to channel A (if any), and the device that should be connected to channel B (if any). The rpm channel has a line, but it will be blank.



Fig. 3: Bump Test icon

To edit or create a Bump Test task setup, do the following:

With the Bump Test icon highlighted, press the “**Menu**” button. Choose “**Task Manager**”. This will bring you to the “**Task Manager**” screen, as shown at right: The first pop-down is a list of Tasks. Choose one from the list, or, if you wish to create a new one, press the “**Menu**” button. Choose “**New**” and then name your new Task. You should name it so that it will be easily recognized in the future.

Next, in the “**Measurement channel**” section, make sure the correct channel is chosen.

Next down the page is the “**Setup**” area with:

- a. A pop-down list of setups
- b. A list of vibration sensors (see note below).
- c. A list of evaluation setups (not used)

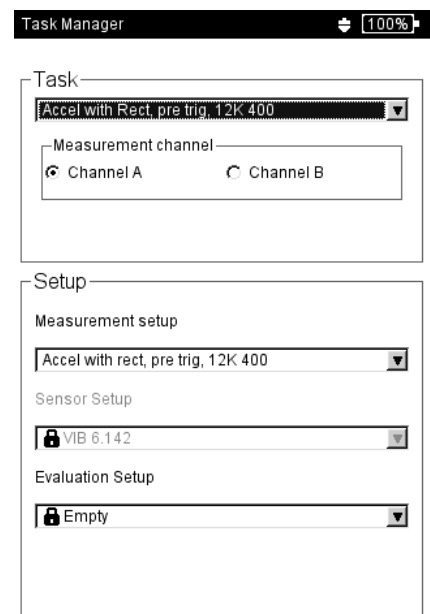


Fig. 4: Task Manager Page

**Remember, if you have a default sensor chosen in the VXP “Device Setup” menu, you will be locked into that sensor in your bump test setup!**

To edit or create a new Measurement Setup, press the “**Menu**” key. If you choose “New” you will first need to name your setup. If you choose an editable setup and you wish to edit it, choose “**Edit**”.

Now you get the “**Setup Manager: Measurement**” screen(see fig. 5).

Meas. Quantity: Choose the units as mentioned in the discussion above.

Lower frequency: This is your High Pass filter. It is best to have it as high as you can tolerate without filtering out important data.

Upper frequency: This is the fmax

Number of lines: Lines of resolution (see note below)

Window type: Rectangular, Hanning, Hamming, Blackman, Bartlett, Flat Top, Kaiser (choose Rectangular)

Average type: Linear, Peak Hold, No Average (choose linear)

No. of measurements: This is the number of samples to average together for the resultant fft. (2 to 4 is common)

Measurement range: The lowest range that works well should be used. This will depend on the physical characteristics of the object being tested.

Trigger type: Level, Without (choose Level)

Trigger level: This is the percent of the measurement range that the energy level must reach before the reading is commenced. This should be very low (choose 5 to 40 %) Just as long as it is not so low that the reading commences because of noise.

Trigger start: This is the time before (if you use a negative number) or after the impact that the reading commences. A negative number will cause the data collection to begin before the impact and a positive number after. Zero will cause the reading to begin on impact.

Negative averaging: No is the choice for the “at rest” bump test, with the machine not running. This is ideal, but if you can’t shut it down, choose “Yes” for Negative averaging. When doing negative averaging, use the Hanning window.

The screenshot shows the 'Setup Manager: Measurement' interface. At the top, it says 'Setup Manager: Measurement' with a '100%' zoom indicator. Below that is a title bar for the 'Measurement setup' window, which is titled 'Accel with rect. pre trig. 12K 400'. The main area contains a list of parameters, each with a text label and a corresponding value in a dropdown menu:

|                     |              |
|---------------------|--------------|
| Meas. quantity      | Acceleration |
| $\Delta f$          | 30 cpm       |
| Lower frequency     | 120 cpm      |
| Upper frequency     | 12000 cpm    |
| Number of lines     | 400          |
| Window type         | Rectangular  |
| Average type        | Linear       |
| No. of measurements | 4            |
| Measurement range   | 7.6455 g     |
| Trigger type        | Level        |
| Trigger level       | 40 %         |
| Trigger start       | -100 ms      |
| Negative averaging  | No           |

**Fig. 5: Setup Manager:**

**Note:** Fmax and the number of lines of resolution are how you adjust the time of the waveform and the resolution of the spectrum. If you increase the number of lines, you increase the time of the waveform and the resolution of the spectrum. If you increase the fmax, you decrease the time of the waveform and the resolution of the spectrum. Generally, the Fmax must be high enough to see any frequencies of interest, and then the number of lines needs to be adjusted to lengthen the waveform enough for full ring-down as was discussed in the beginning of this Technote.

Now press the “**Menu**” button.

Choose “**OK**”

If everything on the Task Manager screen looks ok then press the button again.

Choose “**OK**”

You are ready to start your bump test. With the bump test icon highlighted, (see **fig. 3**) press the joystick. You will first get the initializing screen (see **fig. 6**). If you are using a line drive accelerometer, the initialization will take a few moments longer.

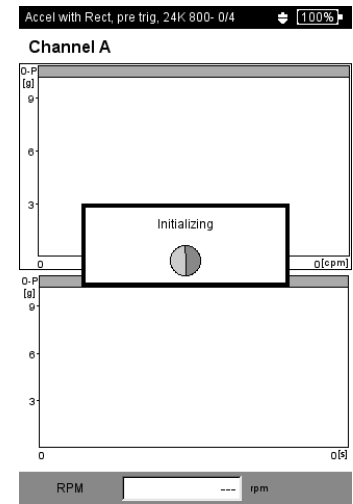


Fig. 6: Initializing

Then, you will get the “Waiting for trigger!” message (see fig. 7). It is now time to deliver your blow. If you have to hit too hard, or you get a message that the signal was overloaded, you may have to adjust your “Measurement range” and or “Trigger level”.

When you have delivered an acceptable bump, you will see the “Keep measurement result?” prompt (see fig. 8). Look over your results. Keep in mind the discussion at the beginning of the technote. If all is acceptable, choose yes. You must repeat the bump and acceptance until you have satisfied the number of averages you chose in the setup. When you have accepted the last average, your resultant spectrum will appear. Press the menu button...

### Choose “Save” and save your bump test.

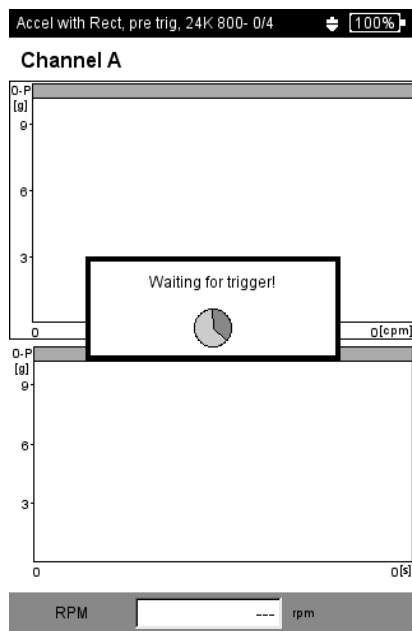


Fig. 7: Waiting for trigger!

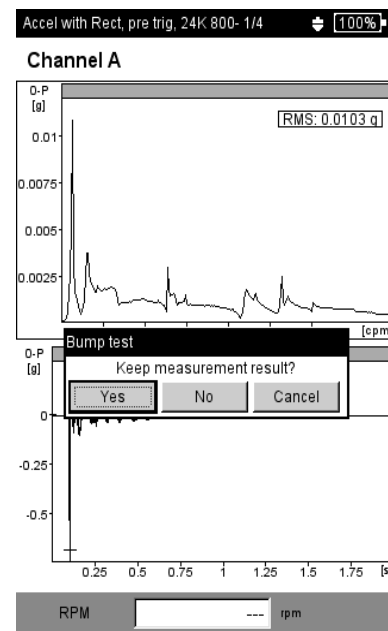


Fig. 8: Keep measurement result!