

# ERRATIC CURSOR PROBLEM WITH MY DELL INSPIRON 1501 WHEN POWERED BY A DC to AC INVERTER

by

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*In July and August 2007 I posted to the Dell Forum website ([www.dellcommunity.com](http://www.dellcommunity.com)), using the login name 'cornwaab', three messages dealing with the erratic cursor / touchpad / inverter issue I had with my new Dell Inspiron 1501 notebook computer. In one of the postings I mentioned looking at waveforms with my oscilloscope of the modified sine wave, AC outputs of typical 12 volt DC to AC inverters and of an uninterruptible power supply (UPS) - which has a built-in inverter. The table on page three of this article shows the waveforms. Below also is a summary of the cursor / touchpad / inverter issue. I want to emphasize that this is a problem encountered only while powering my notebook computer by an inverter, such as in an RV without electrical hookup. Further, the problem may be particular to my equipment.*

## **The Erratic Cursor / Touchpad / Inverter Problem**

I purchased my new Dell Inspiron 1501 notebook computer to use on a project while travelling in my RV (Recreation Vehicle). I am analyzing a large data base and wanted a notebook computer that is faster and has a bigger hard drive than my two older notebooks. Frequently when I am in my RV an AC electrical hookup is not available, and I plug my notebooks into a 12 volt DC to AC inverter. Unfortunately, when my Inspiron 1501 is powered by an inverter, touchpad movement of the cursor becomes erratic. Just laying a finger on the touchpad results in the cursor moving erratically on the screen, and the notebook becomes uncontrollable - at least by the touchpad. When my Inspiron 1501 is plugged into regular AC electricity there is no problem with the touchpad control of the cursor.

Dell technical and sales support have been very attentive in trying to help me solve the problem. Dell sent me a replacement notebook (and power pack) to try and supplied a Targus model PA390C inverter, which Dell sells and supports. I am impressed with and grateful for the efforts of Dell in this regard. Unfortunately, the problem also occurred with the new equipment.

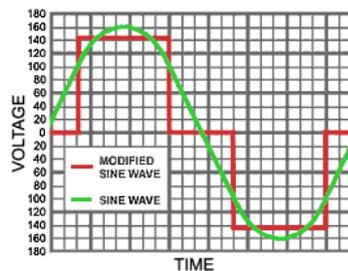
Despite the erratic cursor / touchpad / inverter problem I am pleased with my new Inspiron 1501. It seems well made, and otherwise has functioned very well. Further, there are easy 'work-arounds' to the problem. One is to power the laptop from its internal battery and another is to use an external mouse. (Yet another possible work-around which was suggested, but I have not tried, is to use an auto/air power adapter that integrates the inverter and power pack functions in a single unit.)

There are several messages on the Dell Forum and elsewhere on the Internet referring to other users of Dell Inspiron notebook computers experiencing an erratic cursor / touchpad / inverter problem similar to mine. The possible cause of the problem intrigued me and prompted me to investigate further.

### Possible Cause of the Problem - Inverter Waveform Analysis

I tried three inverters (including the Targus supplied by Dell), of different brands and wattages (140, 150, and 300 watts), with the same erratic cursor outcome. Next I plugged the power pack of my Dell Inspiron 1501 into my APC-500 uninterruptible power supply (UPS), which puts out a modified sine wave variant of AC when there is a power outage. In this case a power outage was simulated by pulling the UPS's power plug out of the AC wall socket. Significantly, there was not an erratic cursor with the UPS-supplied modified sine wave AC. This made me wonder if the difference in result between the inverters and UPS may be due to different modified sine waveforms of the inverters versus the UPS. I examined the respective modified sine waves of the inverters and the UPS with an oscilloscope to see how the waveforms differed.

A modified sine wave is a variant of a square wave, having a positive voltage pulse during one half cycle and a negative voltage pulse in the other half cycle. The graphic below shows a modified sine wave, in red, imposed on a sine wave, in green.

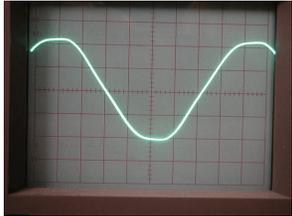
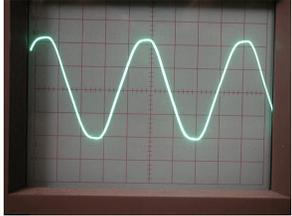
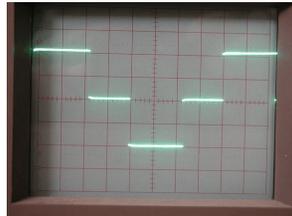
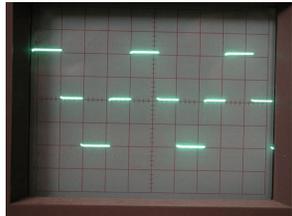


The waveforms of the three stand-alone inverters were very similar, and looked like the modified sine wave in the graphic. Although the discussion below refers to the waveform of the Targus inverter, it applies generally to all three. Pictures of the waveforms of the Targus and the APC-500 UPS are shown in the table on the next page.

If the 'duty cycle' of a true square wave can be thought to be 100%, then the corresponding duty cycle of a modified sine wave is substantially less. For example, looking at the waveforms with an oscilloscope, the duty cycle of the Targus inverter is about 57%,. The duty cycle of the UPS, however, is about only 33%. To compensate for the narrower duty cycle the voltage of the UPS' pulse is about 20% higher.

The waveforms of both inverter and UPS are comprised of respective base frequencies and harmonics. The longer duty cycle of the inverter pulse implies that its base frequency (and harmonic content) would be lower than that of the UPS. Assuming that waveform matters in the

way the cursor behaves, the solution to its erratic movement with an inverter would be to narrow the inverter's modified sine wave pulse and at the same time make it higher. Perhaps an alternative approach would be to insert a high-pass filter between the inverter and power pack.

<p align="center"><b>Oscilloscope Images of Notebook Power 'AC' Waveforms Comparing a Reference Sine Wave with the 'Modified Sine Waves' of the Targus PA390C Inverter and the APC-500 UPS</b></p>		
	Approx. One Cycle	Approx. Two Cycles
<p><u>Reference Sine Wave AC</u> delivered by electric power utility</p>		
<p><u>Targus PA390C inverter</u> Powering my Dell Inspiron 1501 by this Targus inverter (and other makes) causes the cursor to be erratic when controlled by the touchpad.</p>		
<p><u>APC-500 UPS</u> The cursor / touchpad is not erratic when powered by this UPS (AC unplugged), which has a built-in inverter. Note the narrower and higher pulses compared to the inverter unit.</p>	