

PC Based Spectrum Analyzer  
Data Sheet

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11/30/99

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The PC Based Spectrum Analyzer is intended to be an inexpensive replacement for single unit spectrum analyzers. The spectrum analyzer will determine the frequency spectrum of an input signal. This system utilizes a National Instruments 6111E data acquisition board to sample an input signal. Data input to the system will be converted by the analog to digital converters and stored in an on board buffer. The buffer will frequently be transferred into the main memory on the PC. From here the software will convert the acquired data into the frequency spectrum and display that to the monitor. A graphical user interface will allow the user to customize the gain and sample rate of the data acquisition system.

<b>System Inputs</b>	<b>Specifications</b>
Size of Analog Signal	Since the system deals with analog signals, it will not be working with discrete input levels. The voltages of the signals may vary quite drastically from one another. Therefore it is necessary to have a variable gain amplifier circuit on the board. The board we have chosen has selectable gains of 1, 2, 5, 10, 20, and 50. It has an input voltage range of $\pm 10$ Volts, $\pm 20$ Volts, or $\pm 42$ Volts.
Number of Analog Inputs	The selected board has two differential analog inputs. This is sufficient to acquire the frequency spectrum of the circuit. It will also allow the addition of other functionality such as measuring the transfer function of the circuit.
Type of Sample and Hold Inputs	The 6111E DAQ has simultaneous sampling on its inputs. This means that it will perform a sample and hold operation on all of the inputs and then do the analog to digital conversions on the signals individually. This means that two signals can be compared from exactly the same time. Thus there will be no time delay between the two signals, and we can compare what was happening on each input at exactly the same moment in time. This would be useful for determining the transfer function of a circuit since we need to compare the input and output.
Sample Rate of the Analog Inputs	This system will be capable of taking anywhere from 5MS/s (megasamples/second) to 1KS/s. This means that it can sample any signal from 1Hz to 2.5MHz. The maximum of 2.5MHz was determined simply by applying the Nyquist theorem. However, if sampling is performed on very low frequency signals since the minimum sampling speed is 1KS/s some oversampling will occur.
Number of Bits in the A/D Converter	Since analog signals are being sampled an A/D converter is required on the board. The 6111E has a 12-bit A/D converter. This many bits will allow for an accurate reading on the input voltage.

<b>System Output</b>	<b>Specifications</b>
Matlab	The main use of our output will be in the form of a graphical display of the spectrum. This will be done using the graphical tools included with Matlab. The data can also be looked at in a table, that could be loaded into other programs, such as Microsoft Excel. Another benefit of using Matlab is that many of the professors and students in the electrical engineering college have experience using Matlab and thus could apply the output to other programs that may be written.

### **Testing Method**

The spectrum analyzer will be tested by comparing its output to that of existing spectrum analyzers and the FFT function on an oscilloscope. Another method will be to compare our spectrum analysis to the theoretical mathematical results of a given input signal.