

Annex Physics

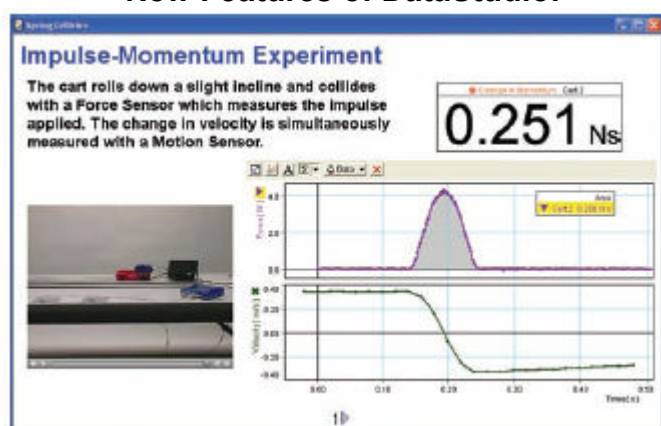
**DataStudio Software**

DataStudio is the only software needed to operate any of PASCO's interfaces. It is a powerful program for collecting, analyzing, and displaying data.

DataStudio Software works with any PASCO interface on both Macintosh and Windows Computers.



**New Features of DataStudio:**



• **Video Player and Synchronization:**

Play a movie or synch a movie to experimental data

• **Improved Curve Fitting:**

Greatly improved curve fitting algorithms allow difficult fits such as sine series and logarithmic data to be analyzed

• **Presentation Style Graph:**

Additional graph style that moves measurements and units outside the graph; ideal for

- publication of DataStudio graphs in educational journals

• **Improved Number Handling:**

Choose from a variety of number displays including significant figures, scientific and fixed precision

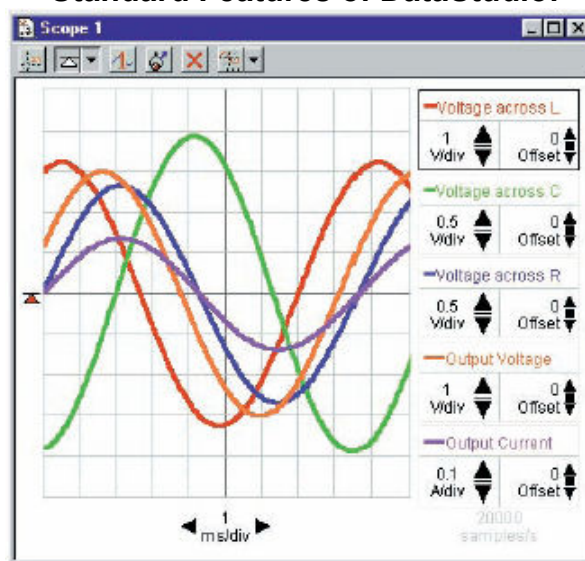
• **Predictive Sketching:**

Students can draw directly on the graph to predict a relationship between two variables. A predicted data set is created as they draw on the graph.

• **Data Run Colors and Symbols:**

Choose or customize the colors and symbols used in any data run

**Standard Features of DataStudio:**



• **Powerful Displays/Analysis Tools:**

Analyze data using a Graph, Table, Meter, Digits Display, FFT, Oscilloscope or Histogram

• **Change or Calculate Anytime, Anywhere:**

No need to stop data collection to make a calculation, choose a curve fit or select data of interest

• **Compatible with ScienceWorkshop or PASPORT sensors:**

DataStudio is the one software needed regardless of the PASCO probeware used

• **Use Any Combination of Sensors:** No restrictions on using digital and analog ScienceWorkshop sensors simultaneously

• **Multiple Languages:** Twelve languages of DataStudio included on each CD

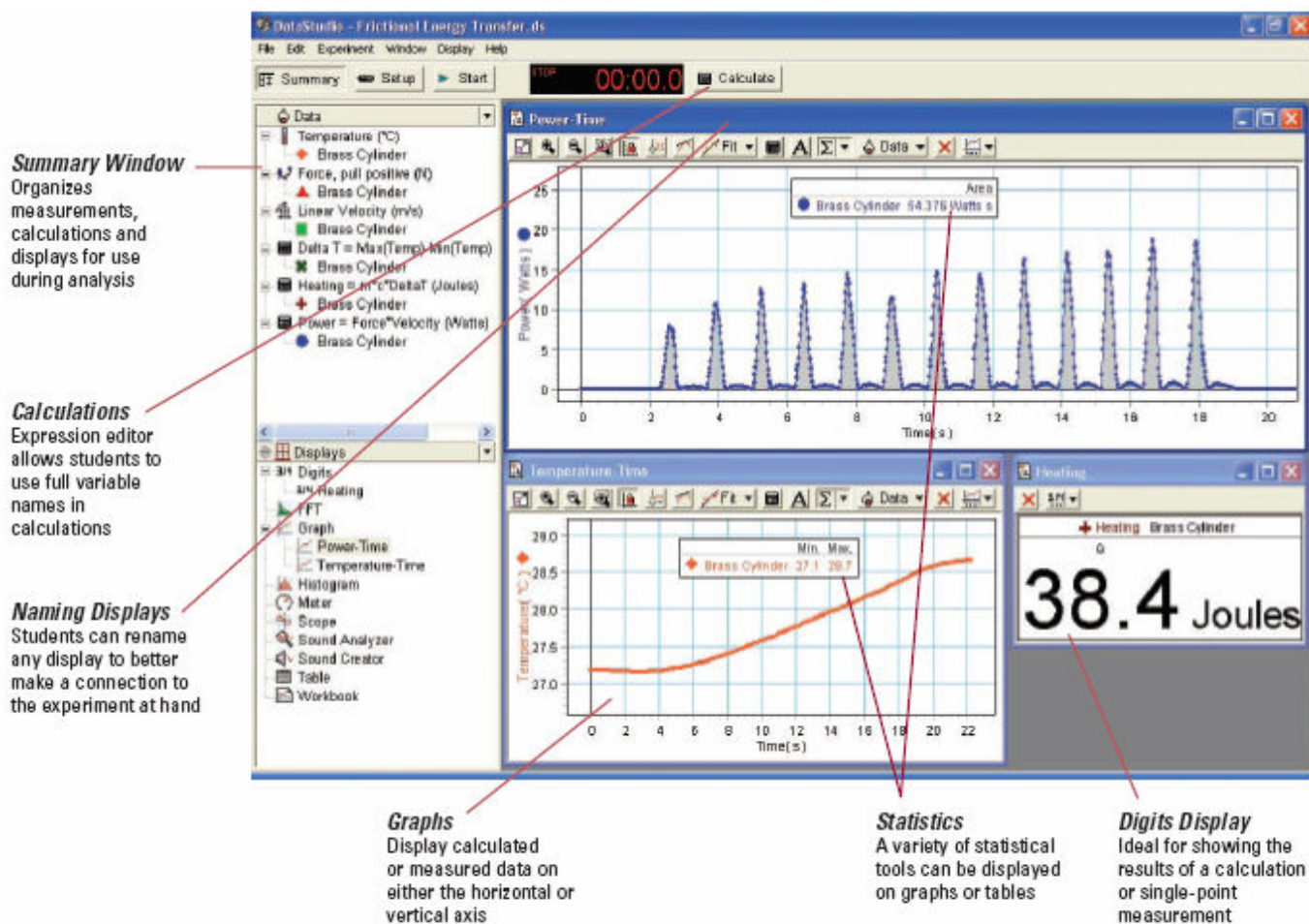
**System Requirements**

**Windows:** Windows 98/2000/ME/XP, Pentium or equivalent processor, 50 MB hard drive space, 16 MB RAM

**Macintosh:** OS 8.6 or higher (including OS X), 50 MB hard drive space, 16 MB RAM.

## Data Analysis with DataStudio:

Using DataStudio, a detailed analysis of the data can be performed:



## Why Buy the Full Version of DataStudio?

Whenever your purchase includes an interface or a sensor, a Lite version of DataStudio is included with your order.

### DataStudio Lite is limited to:

- Viewing and taking data using pre-configured files and electronic workbooks made with the full version
- Taking data and displaying it on a graph, table, or digits display (only one run on each)
- Autoscale, Smart Tool, Statistics, and Data Run Selection on the graph
- Using WAVEPORT, our sound plug-in software (purchased separately, see page 94)

### The full version of DataStudio allows:

- Creating DataStudio experiment files □ Authoring electronic workbooks
- Additional displays: meter, FFT, oscilloscope, histogram
- Multiple instances of each type of display and more than one run on each display
- Start and stop conditions
- Manual sampling
- Calculator
- Curve-fitting
- Graph annotations
- Data Editing
- Synchronizing QuickTime videos and data

500 Interfaces

# 500 Interface Physics Solutions

A versatile solution for all sciences. Combines good desktop performance with datalogging capability. Compatible with over 40 ScienceWorkshop sensors for use in Chemistry, Biology, Earth Science and Physics.

### Features

**Datalogging:**

The ScienceWorkshop 500 Interface collects data directly to a computer, or students can collect data with just the interface and a sensor. Students can set up an experiment using the 500, disconnect from the computer to collect data outside the classroom and then reconnect for data analysis

**Portability:**

With a built-in battery compartment for 4 "AA" batteries (not included) the ScienceWorkshop 500 Interface can go just about anywhere and still collect data

**50 KB Storage Buffer:**

Stores data runs and experiment setup information.

**Cross-Platform Data:**

Logged data will open on either a Macintosh or a Windows-compatible computer. The interface stores the sensor and data display information so it knows what experiment setup to open.

## Physics Solutions

**Simultaneous Analog and Digital Recording**  
Collect up to 3 analog and 2 digital signals at the same time.



**Datalogging Button**  
Press this button to record and store data in the interface's data storage buffer.

**Built-in Battery Compartment**  
Holds 4 AA batteries for field work (also runs on 9 VDC AC adapter included).

### Ports:

- 2 Digital, 3 Analog
- **Connection:** Serial (also USB compatible with USB/Serial Converter)
- **Datalogging:** Collect up to 17,000 Analog (force, voltage, etc.) data points or 7,000 Motion Sensor data points
- **Portable:** Built-in battery compartment
- **Designed for:** Starter, Biology, Chemistry, General Science, Earth Science, Physics, Math

### Specifications Communication Speed:

19.2 kbaud.  
**Crystal-controlled timebase:**  
 ±0.01% accuracy  
**Analog Inputs:**  
 three analog channels  
 A: Differential Input— 2 M $\Omega$  impedance; gain = 1 or 10  
 B: Single Ended Input— 200 k $\Omega$  impedance; gain = 1 or 10  
 C: Single Ended Input— 200 k $\Omega$  impedance; gain = 1 $\pm$ 10 V range ( $\pm$ 0.02 V + 0.1% of reading); 5 mV resolution 12-bit ADC analog converters  
**Digital Inputs:**  
 two digital I/O channels 5  $\mu$ s timing resolution  
**Datalogging mode without a Computer:**  
 Disconnect from your computer and take remote measurements. Low power consumption mode prolongs battery life.  
 50 KB Storage Buffer: Collect 17,000 Analog (force, voltage, etc.) data points or 7,000 Motion Sensor data points.  
 50 KB data storage buffer (2N+1 bytes/sample period, N=# chs, eg: 2 chs @ 10 Hz for 1,000 seconds)  
 Multiple data runs are appended to the buffer.  
**Cross-platform Data:**  
 Logged data will open on either a Macintosh or Windows-compatible computer. The interface stores the sensor and data display information so it knows what experiment setup to open.  
**Power Supply:**  
 9 V@500 mA DC supply or a battery pack (4 AA). All inputs and the serial interface have ESD (electrostatic discharge) protection circuitry that works with power on or off.

### Make the 500 Interface more Powerful with the USB/Serial Converter



The USB/Serial Converter is the ideal solution for connecting the 500 Interface to the USB port of a computer. USB to serial adapters produced by other companies rely on constantly changing drivers that may or may not work well with a computer. PASCO's USB/Serial Converter is specifically designed for use with the 300, 500 and 750 Interfaces. Simply install the included version of DataStudio and begin collecting data. Not only is the USB/Serial Converter easy to use, it boosts the performance of the 500 Interface significantly.  Increases continuous data sample rate by a factor of 8.  Increases the oscilloscope display refresh rate by 5 times, providing a near real-time oscilloscope for examining electrical circuits, sound waves and more.  Enables students to download a buffer of logged data (up to 17,000 data points!) in seconds (versus minutes using the serial connection). The maximum sample rate for the 500 interface remains 20,000 HZ.

750 Interface

750 Interface Physics Solutions

750 Interface is the measurement center for the modern physics laboratory. Using a computer and the 750 Interface, students can measure force, position, temperature, pressure, angular velocity, acceleration, current, magnetic field and more. Each 750 Interface includes a built-in function generator and real-time Oscilloscope mode.

**Serial Port Connection**  
The 750 can be connected to the serial port of a computer. Students will always be able to use the 750 – even on a computer without a SCSI connection.

**USB or SCSI 2**  
Connection models available.

**Seven Input Channels** With the 750, all 7 channels may be used simultaneously. There are no limitations on what combinations of sensors can be used. Analog and digital inputs may be mixed in any combination.  
 □ **Four Digital Channels**  
Use up to 4 Photogates or 2 Rotary Motion Sensors, a photogate and Motion Sensor II, or any other combination.  
 □ **Three Analog Channels**  
Max sample rate of 250,000 Hz when using a single channel.

**The ScienceWorkshop 750 Interface contains:**  
 □ Flash EPROMs and Field-Programmable Gate Arrays (FPGA) for easy field upgrades  
 □ Dual Port RAM that allows direct memory access (DMA) for fast data transfer  
 □ Semi-RISC 32 MHz microprocessor  
 □ 8x Oversampling  
 □ Surface Mount, Multilayer Circuit Board  
 □ On-board, Active SCSI termination

**Built-in Function Generator** 1.5 Watt function generator is ideal for basic circuit experiments and low power uses of speakers, wave drivers and sonometers.

Features

- **250,000 Hz Sampling Rate:** Sample at 250,000 samples per second on a single analog channel. Students will see a true, real-time oscilloscope and incredibly responsive sound sensor data.
- **Built-in 1.5 W Function Generator:** Any experiment requiring a frequency up to 50 kHz and 1.5 watt (300 mA) output can be run without additional power amplification. Output current and voltage can be monitored internally by the 750 Interface
- **20 kHz Oscilloscope:** With the 750's increased sampling rate, the oscilloscope becomes a real-time scope with refresh rates up to 40 frames per second.
- **SCSI or USB connection:** Both feature a maximum sample rate of 250,000 Hz and real-time oscilloscope modes with refresh rates of 30-40 frames per second.
- **Reduced Noise, More Accurate Data:**  
When sampling at rates less than 100 samples per second, circuit noise can be visible on a data graph. The 750 Interface, however, provides 8X oversampling to reduce noise and provide smoother data curves.
- **Serial Port Convenience:** A serial port is available on the SCSI version.

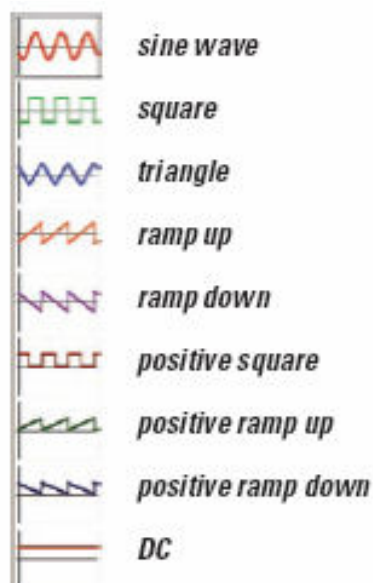
Unique Characteristics

- **Ports:** 4 Digital, 3 Analog, 1 Output
  - **Connection:** SCSI/Serial or USB
  - **Data Sampling:** Simultaneous Analog and Digital Recording
  - **Analog Rates:** Up to 250,000 samples/ sec (20 KHz Oscilloscope)
  - **Digital Rates:** 0.1 msec digital timing accuracy (1 mm resolution for Motion Sensor)
  - **Function Generator:** 0-50 KHz, 1.5 W (300 mA) output
  - **Power Amp Compatible**
  - **Designed for:** Advanced Placement and College Physics
- Specifications Power:**  
12 VDC to 20 VDC at 2 A, 2.1 mm jack
- SCSI connection:**  
8-bit width, MDB50 female, internal active termination
- Serial connection:**  
Serial RS-232, 8-pin MDIN female, 19.2K bits/s, 1-8-1
- Digital Channels:**  
4 identical channels, TTL compatible (8 mA max. drive current)  
Maximum input logic transition time: 500 ns  
Edge sensitive-sampled at 10 KHz. (1 μs res. for Motion Sensor)
- Analog Input Channels:**  
3 identical channels with differential inputs and 1 MΩ impedance  
±10 V maximum usable input voltage range

- (±12 V absolute input voltage range)
  - 3 voltage gain settings on each analog channel: 1, 10, and 100
  - Small signal bandwidth up to the ADC: 1 MHz for a gain of 1, 800 KHz for a gain of 10, and 120 KHz for a gain of 100;
  - input amplifier slew rate: 1.2 V/μs
- Electrostatic Discharge (ESD) protected**  
Both digital and analog inputs have ESD protection.
- 12-bit Analog-to-Digital Conversion:**  
5 inputs: channels A-C, analog output voltage and current.  
Voltage resolution at ADC input: 4.88 mV (.488 mV at a gain of 10, 0.049 mV at a gain of 100)  
Current measurement resolution: 244 μA, (1 V = 50mA) mA  
Offset voltage accuracy < ±3 mV.  
(For measuring full-scale voltages the total error is less than ±15 mV, accounting for the gain error in the input amplifier.)  
Sample rate range: once every 3,600 seconds (250 KHz) (Conversion time for consecutive channels in a burst is 2.9 μs.)  
8X oversampling for better accuracy at sample rates <= 100 Hz.
- Analog Output:**  
DC value ranges: -4.9976 V to +5.0000 V in steps of 2.44 mV  
Accuracy at the DIN connector: (±3.6 mV ±0.1% full scale)  
Peak-to-peak amplitude adjustment ranges for AC wave form: 0 V to ±5 V in steps of 2.44 mV  
AC waveform frequency ranges: 0.001 Hz-50 KHz, ±0.01%  
Maximum amplified output at the banana jacks: about 300 mA at ±5 V, current limited at 300 mA ±12 mA

**750 Interface Output Waveforms:**

Data Studio software controls the 750 interface to output the following waveforms (from 0.001 Hz to 50 kHz):

**Power Amplifier II**

The Power Amplifier II connects to one analog channel of the *ScienceWorkshop 750* interface to amplify the output signal up to  $\pm 10$  V at 1A.

**Specifications****Output:**

- Variable Voltage:  $\pm 10$  V
- Current: up to 1 Amp
- Frequency: from DC to 50 kHz
- Resolution: 0.01 Hz
- Low Output Impedance:  $<1 \Omega$
- Line and Load Regulated

**Overload Indication:** LED

**Connector:** 8 -pin DIN for *Science Workshop 750* and *700* Interfaces

**Interface Capability:** for *Science Workshop 750* and *700* Interfaces only

**Use a 750 SCSI Interface with a USB Port**

The USB/Serial Converter is the ideal solution for connecting a 750 SCSI Interface to the USB port of a computer. USB-to-serial adapters produced by other companies rely on constantly changing drivers that may or may not work well with all devices. PASCO's USB/Serial Converter is specifically designed for use with the 300, 500 and 750 Interfaces. Simply install the included version of DataStudio and begin collecting data.

