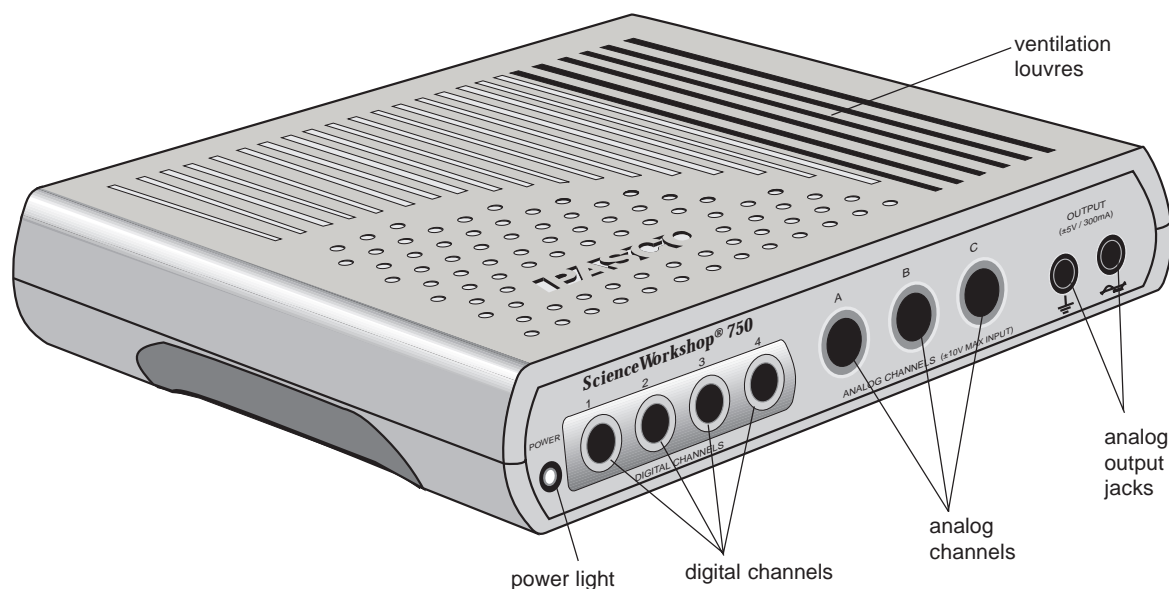


**Instruction Sheet
for the PASCO
Model CI-7500**

SCIENCE WORKSHOP® 750 INTERFACE



Introduction

The PASCO CI-7500 *Science Workshop*® 750 Interface, a data acquisition computer interface, is an upgrade of the *Science Workshop* 700 Interface. It performs all of the functions of the 700 Interface, and includes the following improvements:

- analog samples up to 250,000 samples/second;
- rates through the SCSI port up to 4 times faster than the 700;
- identical analog input channels—all differential inputs, each with three gain settings: 1, 10, and 100;
- internal power amplifier for DC supply and wave function generation up to 300 mA;
- 12 bits of AC amplitude precision, allowing amplitude adjustments in steps of 2.4 mV;

- access to the analog output signal through banana jacks, allowing output voltage and current to be monitored without occupying one of the analog input channels or requiring an external power amplifier.
- greater accuracy with motion sensing events;
- AC wave frequency generation up to 50 KHz (10 times faster than the 700);
- automatic readjustments of analog input offset to zero;
- upgradable firmware via flash ROM;
- option to operate through a serial port connection when a SCSI port is not available.

Instructions for operating the *Science Workshop* 700 in the *User's Guide for Science Workshop* apply to operation of the 750 Interface except for the items detailed in this document.

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Equipment

INCLUDED

- Science Workshop 750 Interface box
- 12 V, 2 A power supply
- connecting cable with a DB25 connector for the computer SCSI port and a MDB50 connector (high density 50-pin) for the 750 interface box
- Adaptec SCSI card

OPTIONAL

- An optional cable for connecting the 750 Interface to a serial port is available. Note that the maximum data rate through a serial port is much less than that through a SCSI port.
- cable with an 8-pin MDIN on each end for the Macintosh (part no. 514-002)
 - cable with an 8-pin MDIN connector for connecting with the 750 interface and a DB25 for connecting with a Windows serial port (part no. 514-5965; for a computer with a 9-pin serial port, also order the 25-pin to 9-pin adapter, part no. 514-009.)

Operation

Operation with Science Workshop on a Windows computer

The 750 Interface must be turned on before the computer is powered up—Windows will only recognize SCSI devices during the boot process.

Power Supply

The 750 derives its main power from an external table top power supply. All of the operating voltages are generated inside the 750 Interface.

SCSI Connection

The main connection to the computer is through the SCSI port. The 750 has an improved SCSI data transfer rate which can be about 4 times that of the 700 interface, depending on the computer speed. The SCSI cable has a DB25 connector for the computer and a MDB50 connector (high density 50-pin) for the 750 interface. The 750 has only one connector on the back panel, and therefore **it must be the last SCSI device in the chain**. The SCSI bus is actively terminated inside the 750; there is no need for external

termination of the SCSI bus. **All devices in the SCSI chain (CD-ROMs, scanners, etc.) must be powered up during operation of the 750 Interface.**

The SCSI ID number is preset to 2 at the factory. If you wish to change the ID number, simply change the switch setting on the back panel and cycle the power. The interface reads the switch only at powerup.

► **Note:** To avoid conflicting with other SCSI devices on your system, be sure to check for free ID numbers before changing the SCSI ID number.

Optional Serial Port Connection

For the situation where a SCSI port is not available, the 750 can be connected via the serial (COM) port. However, the maximum data transfer rate is much less than for the SCSI port. For the part number for the connecting cable, refer to the optional equipment list.

Flash Memory

The 750 stores its operating system (also waveform patterns) in flash memory. Therefore, shortly after powerup, the interface is running the operating system (OS) without requiring initialization from Science Workshop. Science Workshop can upgrade the resident OS and waveforms in flash memory when a new revision is available.

⚠ During operation, do not block the louvres on the top and bottom of the interface box.

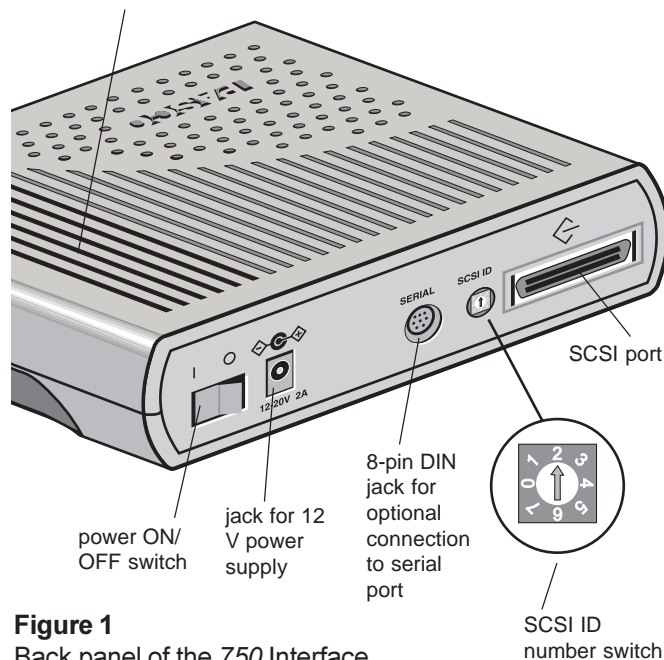


Figure 1
Back panel of the 750 Interface

Analog Input Channels

The 750 has three identical analog input channels. Each has differential inputs; in other words, they are like the inputs to a volt meter where neither lead is connected to ground. The voltage measured is the voltage difference between the inputs. Each channel has three software-accessible gain settings: 1, 10, and 100.

The maximum sample rate depends on which channels are selected for measurement. For the higher rates, *Science Workshop* samples a block of 2000 bytes and then transfers the block. Once transfer of bytes to the host has started the interface starts sampling a new block. This is called burst mode since there is a small time interval when data is not being sampled. The main use for this mode is for the virtual oscilloscope. Table 1 shows the sampling constraints while using a fast computer to record the data.

Table 1. Sampling Rate Constraints

Sample Rate	# of Channels	Comment
250 KHz	1 analog	Burst mode
100 KHz	3 analog	Burst mode
50 KHz	5 analog	Burst mode
20 KHz	1 analog (5 analog)	Continuous* (burst)
10 KHz	1 analog + digital (5 analog)	Continuous* (burst)
≤ 100 Hz	5 analog	Continuous 8x oversample (improved accuracy at ≤ 100 Hz)

*Note: Continuous sampling with 5 channels selected is not possible to sustain for more than a few seconds.

There are five analog channels from which to choose: channels A–C, analog output voltage (at banana jacks), and the analog output current. Please note that for continuous sampling, the speed of the computer is a significant factor, especially if *Science Workshop* is busy with many displays.

► **Note:** When a digital sensor has been selected, the sampling rate does not depend on the number of

digital channels since they are sampled simultaneously at 10 KHz.

Built-in Function Generator-Amplifier

The 750 has a built-in function generator that is used to output analog signals. These can be either AC signals, such as sine and triangle waveforms, or a DC signal ranging between +/- 5 V. For the AC waveforms, of which there are 8 resident in Flash, the frequency can range from 1 mHz (0.001 Hz) to 50 KHz and the peak-to-peak amplitude can be adjusted from 0 V to +/-5 V with increments of 2.44 m V. The output voltage is calibrated at the factory to null the offset voltage and set the full scale voltage.

Accessing Analog Output

There are two different ways in which to access the analog output signal. The first (the default method in *Science Workshop*) is to connect test leads to the banana jacks. The signal produced is a power amplified (unity voltage gain) version of the signal present at the DIN connectors and can supply nearly 300 mA at +/-5 V. The output current can be monitored along with the output voltage. The second is to use a CI-6552A Power Amplifier (which has a voltage gain of 2 and delivers 10 W) and connect its DIN plug to one of the analog channels, A–C.

Digital Event Sampling

The 750 can sample digital events for photogate timing. The 750 uses hardware edge detection so that it can capture either edge or both as events, a feature that is useful for setting trigger conditions. It can count digital events from devices such as a Geiger tube or a Rotary Motion Sensor. Each channel has an independent 16-bit counter. For motion sensing, either single or dual, the internal counters and edge detectors provide improved performance with less noise in the measurement.

Operation Precautions



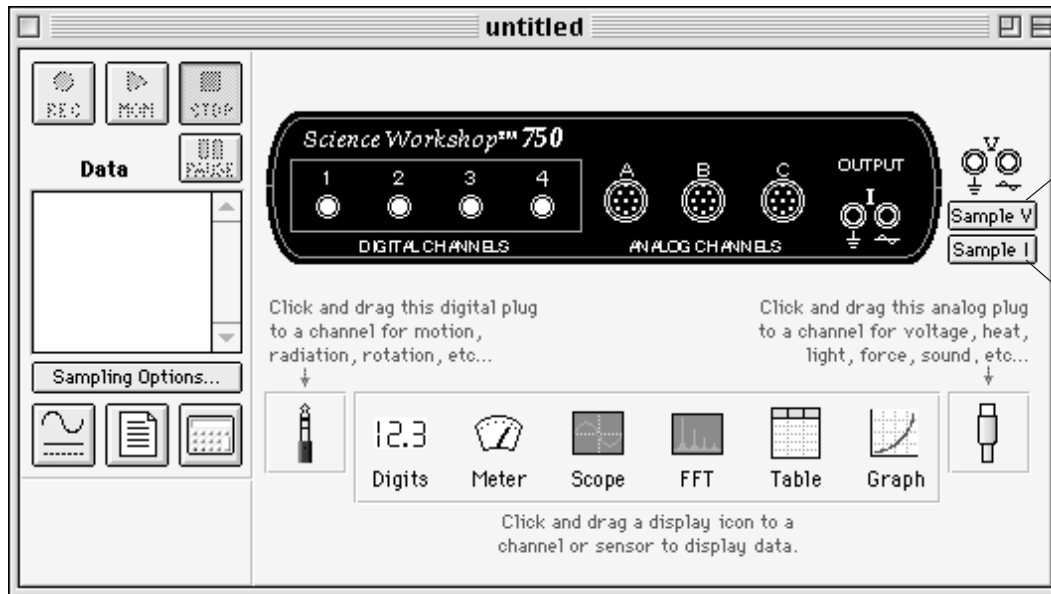
Do not block the ventilating louvres on the top and bottom of the interface box during operation.

New Science Workshop Features for the 750 Interface

Experiment Setup Window

The Experiment Setup window of *Science Workshop* for the 750 Interface differs slightly from that of the 700 Interface as follows:

- The **Sample OUT** button has been replaced by the **Sample V** button, but the functionality remains the same: both allow the sampling of the voltage of the output signal. Clicking the **Sample V** button also opens the Signal Generator window.



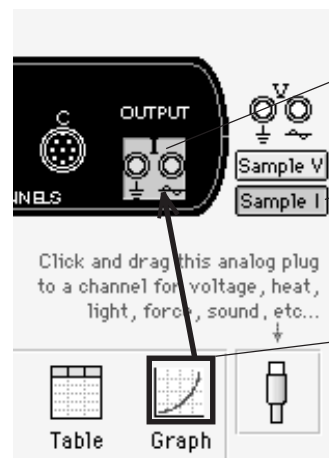
Sample V button
(Click to open the Signal Generator window and to sample its voltage at the output terminals on the interface box.)

Sample I button
(Click to sample the current at the output terminals.)

- The new **Sample I** button activates sampling of current at the OUTPUT terminals on the 750 Interface box. Clicking the **Sample I** button will cause the OUTPUT icon to be highlighted. To open a Graph display of Current vs. Time, drag a Graph display icon to the highlighted OUTPUT icon.

➤ **Note:** For the oscilloscope, which displays volts vs. time, each volt represents 50 mA.

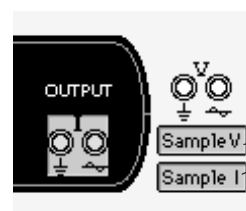
These new features enable the sampling of output voltage and current while leaving three analog channels available for other sensors.




highlighted OUTPUT icon

activated **Sample I** button

Drag the Graph icon to the highlighted OUTPUT icon to create a Graph display that plots **Current vs. Time** at the OUTPUT terminals.



Click both buttons to sample output voltage and output current.



The exclamation point within an equilateral triangle is intended to alert the user of important operating and safety instructions that will help prevent damage to the equipment or injury to the user.

New features of the Signal Generator

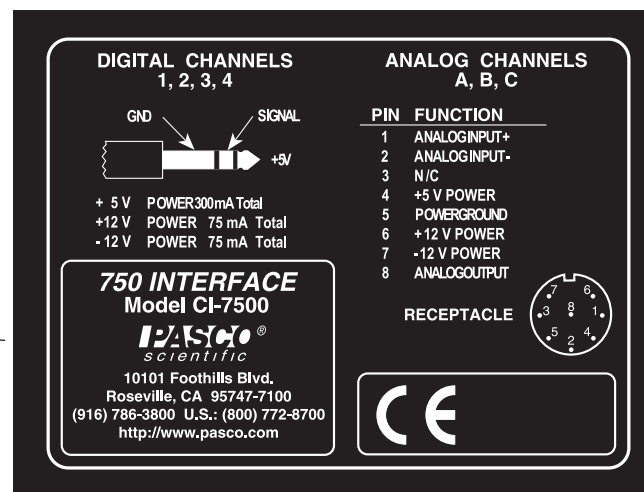
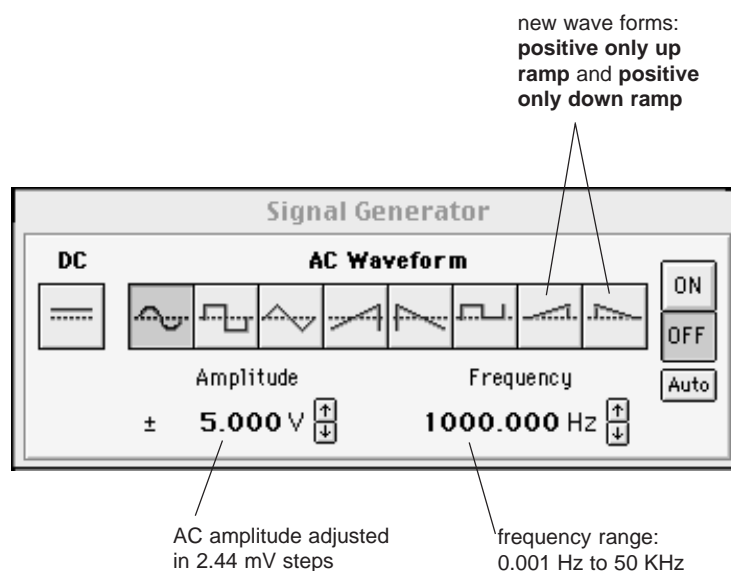
- Two new wave forms: *positive-only up ramp* and *positive only down ramp*

► **Note:** When operated with *Science Workshop* version 2.3 or higher, the 700 Interface will also generate these positive-only up and down ramp signals.

- Expanded frequency range: 0.001 Hz to 50 KHz
- Greater resolution for adjusting the AC amplitude (steps of 2.44 mV)

► For detailed instructions concerning the Signal Generator, refer to the *User's Guide for Science Workshop* (the section titled *Operating the Science Workshop Program, Signal Generator*).

The label on the bottom of the interface box details the channel power specifications.



The PASCO Model CI-7500 750 *Science Workshop* Computer Interface has been tested and complies with the essential protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Assessment of compliance of the product with the requirements relating to electromagnetic compatibility was based on the following Directives and Standards:

- EN 50081-1 Electromagnetic compatibility generic emission standard
- EN 55022, CISPR 22 Class A Limits and methods of measurements of radio interference characteristics of information technology equipment.
- EN 50082-1 Electromagnetic compatibility generic immunity standard.
- IEC 801-2 Electrostatic discharge requirements
- IEC 801-3 Radiated electromagnetic field requirements
- IEC 801-4 Electrical fast transient/burst requirements

Specifications

Power:

- 12 VDC to 20 VDC at 2 A, 2.1 mm jack

Primary computer connection:

- SCSI, 8-bit data width and a MDB50 female connector
- Internal active termination provided

Alternate computer connection:

- Serial RS-232 with an 8-pin MDIN female connector
- 19.2K bits/s, 1 start bit, 8 data bits, 1 stop bit

Digital Channels:

- 4 identical digital input/output channels
- TTL compatible input/output levels with 8 mA maximum drive current
- maximum input logic transition time: 500 ns
- Electrostatic Discharge (ESD) protected inputs assuming the human body model standard, Mil-Std-3015.7
- edge sensitive and sampled at 10 KHz (100 μ s). (1 μ s resolution for the Motion Sensor)

Analog Input Channels:

- 3 identical channels with differential inputs and 1 M ohm impedance
- +/-10 V maximum usable input voltage range (+/-12 V absolute input voltage range)
- ESD protected input similar to that of the digital channels
- 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/ μ s (The actual bandwidth is determined by the sampling rate of the ADC.)

Analog-to-Digital Conversion:

- 5 input sources for the 12-bit ADC: channels A–C and analog output voltage and current.
- voltage resolution at the ADC input: 4.88 mV (.488 mV at a gain of 10, 0.049 mV at a gain of 100)
- current measurement resolution: 244 μ A, where each volt measured represents 50 mA
- offset voltage accuracy < +/-3 mV. (For measuring full-scale voltages (or 1 V with a gain of 10, etc.) the total error will be less than +/-15 mV, accounting for the gain error in the input amplifier.)

- sample rate range: once every 3600 seconds – 250 KHz (The conversion time between consecutive channels in a burst is 2.9 μ s.)
- 8X oversampling for improved accuracy for sample rates \leq 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 waveform: 0 V to +/-5 V in steps of 2.44 mV
- AC waveform frequency ranges: 1 mHz (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

Limited Warranty

PASCO scientific warrants the product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. PASCO will repair or replace, at its option, any part of the product which is deemed to be defective in material or workmanship. The warranty does not cover damage to the product caused by abuse or improper use. Determination of whether a product failure is the result of a manufacturing defect or improper use by the customer shall be made solely by PASCO scientific. Responsibility for the return of equipment for warranty repair belongs to the customer. Equipment must be properly packed to prevent damage and shipped postage or freight prepaid. (Damage caused by improper packing of the equipment for return shipment will not be covered by the warranty.) Shipping costs for returning the equipment after repair will be paid by PASCO scientific.

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