

# **EAS SpeedDaq 12bit 8Channel A/D System**

**Ver. 3/6/2003**

**Embedded Acquisition Systems**

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SpeedDaq is an external multi-range, 8 channel, 12bit analog to digital acquisition board for the IBM PC. It connects to the PC parallel port. Typical uses are high speed strip chart recording, data logging, process control, an electronic workbench, etc. When used with National Instruments Labview, it becomes a very versatile instrument for process control and data logging. With the supplied software libraries, you can create custom control and data logging applications in C, BASIC, and Excel

## SpeedDaq Assembly

### Construction notes

This kit requires good soldering techniques due to its small size.

Tools necessary: A fine tip soldering gun and a good wire cutter.

Recommended tools: Mechanical clamp-known as a third hand, fine solder wick to remove excess solder.

**Caution:** Integrated circuits U1 and U2 are static and heat sensitive. Do not apply too much heat with your soldering iron when installing these two parts. Please take precautions while handling U1 and U2 to protect against static electricity, ground your body before handling these parts.

### Step 1

Start by installing the capacitors C1, C2, C3, C4, and C5. Observe capacitor polarity for C2 and C5.

C1 - 100pf monolithic capacitor

C2 - 4.7uF tantalum, 6volts

C3 - .01uF monolithic capacitor

C4 - .1uF monolithic capacitor

C5 - 10uF tantalum, 6volts

### Step 2

Install diode D1. Observe silkscreen markings when installing the diode. The black line on the diode is the cathode and should be installed in the same orientation as the silkscreen marking.

D1 - 1N4007 diode

### Step 3

Install resistor R1.

R1 – 47 ohm

### Step 4

Install the DB25 connector. It is installed with the leads lined up with the pads on the PCB. Make sure the connectors are pressed flush with the board and that you have the correct connector gender before soldering. Pin1 on the connector should line up with the silkscreened pin1 on the PCB.

P1 - Male DB25 solder tail (Digikey part# 1125M-ND or equivalent)

### Step 5

Install the 10 position header/screw terminal JP1.

### Step 6

Install the voltage regulator U1 and a 28pin IC socket for U2. Observe proper orientation for pin 1.

U1 - LM78L05

U2 - 28 pin I.C. socket for MAX197ACNI

**Step 7**

On the bottom side of the board, near the 10 position screw header, is solder jumper J1. It looks like two small square pads. This is the single point ground, which connects the analog and digital grounds together. You must put a small blob of solder to connect the two square pads together. SpeedDaq will not work if you skip this step.

**Step 8**

Wash and clean the completed board before installing the Max197 in the I.C. socket. We use water soluble flux solder here at EAS. This permits easy board cleaning. Radio Shack sells flux removing solvent made for pc board cleaning. Take a close look at all solder joints and touch-up any that look bad. A 2x or 3x magnifying glass helps to find any solder bridges.

**Step 9**

Testing the SpeedDaq.

SpeedDaq requires a DC supply voltage between 8 to 12volts. A small low power 12 volt wall wart from Radio Shack will work fine. Connect the negative supply line to screw terminal pin 9 and the positive supply line to screw terminal 10.

Plug the SpeedDaq P1 connector to the PC parallel port. You can use a short 2 or 3 foot cable to connect the SpeedDaq to your computer. Make sure the cable you use has all 25pins extended.

Download `calibr.exe` and `brun45.exe`. These programs can be found on our ftp web site, <http://www.embeddedtronics.com> under the /Electronics/speeddaq/qbasic directory.

Calibr.exe is a DOS application and brun45.exe is the runtime library needed to run. Start the program and choose P to set the parallel port to the one you have the SpeedDaq plugged into. If the board is working correctly, you should see changing data on the screen. Connect a 1.5volt battery to analog input 0 (pin 1) and analog ground (pin9). You should immediately see the 1.5 volts displayed on the screen.

Test all the other channels by moving the battery lead to the other analog input channels and changing the displayed channel by choosing and setting "C".

## Connecting to the SpeedDaq

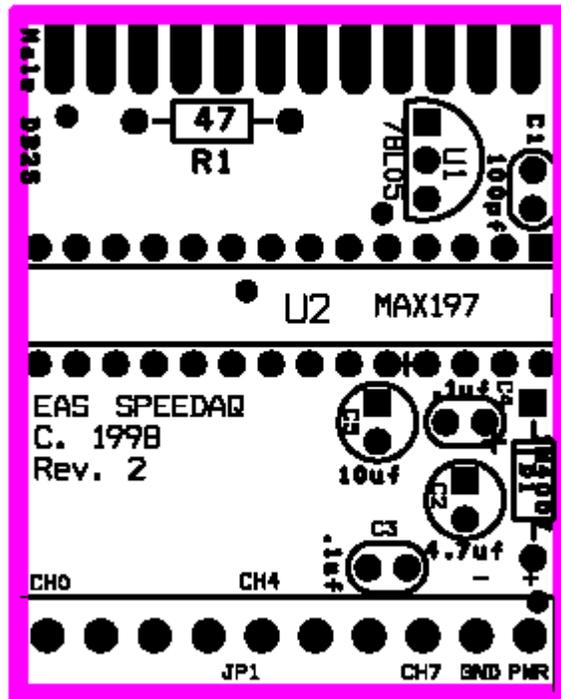
JP1 screw terminal is where the analog input signals are to be connected. Pin 9 also serves as the analog input signal ground. Pin 10 terminal is for the external power supply +.

Pin #	Connector JP1 pinout
1	Analog input channel 0
2	Analog input channel 1
3	Analog input channel 2
4	Analog input channel 3
5	Analog input channel 4
6	Analog input channel 5
7	Analog input channel 6
8	Analog input channel 7
9	Ground
10	+ External DC power input (6-12 volts)

## Parts list for SpeedDaq

Item	Quantity	Part Reference#	Description
1	1	C1	100pf monolithic capacitor
2	1	C2	4.7uF tantalum, 6volts
3	1	C3	.01uF monolithic capacitor
4	1	C4	.1uF monolithic capacitor
5	1	C5	10uF tantalum, 6volts
6	1	D1	1N4007 diode
7	1	JP1	10 position header/screw terminal
8	1	P1	Male DB25 solder tail (Digikey part# 1125M-ND or equivalent)
9	1	R1	47 Ohm resistor
10	1	U1	LM78L05
11	1	U2	MAX197ACNI (28pin narrow dip version)
12	1		28 pin I.C. Socket

SpeedDaq PC board silkscreen layout



## Frequently Asked Questions (FAQ)

Please check out web site for the latest version of the FAQ.

### **The board shows voltages on other A/D channels, even though nothing is connected.**

This should not affect the readings of your current channel. Because of the internal multiplexing done by the A/D, other channels will float. We recommend grounding all unused analog input channels.

### **The board works but it doesn't zero when grounded.**

This is normal. There will be minor offset error between all channels. These are very small and consistent values that can be nulled out in software. Typically, A/D software programs incorporate a calibration procedure by grounding all channels and recording the offsets. By subtracting these small offsets from the acquired data value you will get an adjusted reading to compensate for the error.

### **The SpeedDaq was working until I put a higher voltage than specified.**

Try unplugging the SpeedDaq from the PC parallel port and plugging it back in. This will reset the board and release any latch up conditions. Damage to the SpeedDaq may occur if you exceed recommended input voltage.

### **How can I further protect my Computer from my experiments?**

You can use a secondary add on parallel port ISA card for the interface to the SpeedDaq. If the maximum input voltages have been exceeded, the parallel port board provides an extra layer of protection between your circuit and the motherboard of your PC. You can purchase 3<sup>rd</sup> party add on ISA parallel port boards for \$19 or less at your local computer supply store.

### **Can I damage the A/D if I accidentally exceed the maximum input voltage?**

The input to the A/D has a Fault-Protected Input Multiplexer ( $\pm 16.5V$ ). Do not exceed  $\pm 16.5V$  or damage to the Max197 chip may occur.

### **How can I increase the A/D sample rate?**

Sample rate varies with the speed of your computer. The faster your PC is, the higher the sample rate. Although the Max197 chip itself is rated at 100 Khz sampling rate, sample frequency is effected by software overhead and by Windows itself. You can run in a Dos environment to get better results. We have provided interface libraries for C and Quick Basic. In Labview, optimized loops will significantly increase your sample rate.

## Trouble shooting

The most common problems are improperly configured parallel port or attempting to use the wrong parallel port address. Verify the port is working by connecting a printer and performing a print test. Some parallel ports are not configured to run in bi-directional mode. Most modern pc's have the ability to change the parallel port type in the system BIOS. Changing the port type to SPP or EPP mode will make it bi-directional compatible. Parallel ports on older pc's may not be not bi-directional capable. The purchase of a ISA slot parallel port I/O card from your local pc store can solve this problem.

Check and make sure all components are installed and properly orientated.

Check diode polarity.

Check IC pin 1 positions.

Check Tantalum capacitor polarity.

Check for shorts.

Check for cold solder joints.

Cable from PC to SpeedDaq should be 6 foot or less. Shorter is better.

Check your power supply adapter, it should have a DC voltage output between 8-12 volts.

**Specifications:**

12 bit, eight channel single ended input (4096 discrete points).

12-Bit Resolution, 1/2LSB Linearity

Software-Selectable Input Ranges:  $\pm 10V$ ,  $\pm 5V$ , 0V to 10V, 0V to 5V

Fault-Protected Input Multiplexer ( $\pm 16.5V$ )

8 Analog Input Channels

Single channel A/D sample speed: approximately 30,000 samples/sec using a Pentium 450. Depending on the speed of your computer, the actual sample rate may vary. Data acquisition speed test program written using Microsoft Quick Basic v4.5 calling C runtime QLB library.

Requires compatible bi-directional PC parallel port.

**Power requirements:**

Requires external 8 to 12volt DC supply.

**Dimensions:**

2.25" long 2.1" wide .65" deep

**Software:**

Software drivers (Dos, Win95/98/ME only) and updates may be downloaded from our WEB site.

Do not exceed maximum analog input voltage ( $\pm 16.5V$ ) or damage to SpeedDaq may occur.

## STANDARD LEGAL STUFF

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