Universal Stamp Board

Owner's Manual

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Universal Stamp Board Kit Contents

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- 5 ea, ULN2003A, Hi-voltage/current, Darlington transistor array.
- 2 ea, nine bussed resistor pull up/down network (1.5kΩ)
- 2 ea, seven bussed resistor pull up/down network (1.5kΩ)
- 4 ea, Shorting Headers
- 1 ea, 12volt/1.5amp, AC adapter power supply.
- 1ea, Resources CDROM.
- 1 ea, BS1 Serial Adapter.
- 12 ea, jumper wire terminated on both ends (2 ea black, 10 ea, red)
- 12 ea, jumper wire terminated on one end, stripped on other (2 ea black, 10 ea, red)
- 1 ea box of assorted interconnect wires for solderless breadboard connections.
- 1ea, RS232, straight-thru, male-to-female cable terminated with SubDB-9 connectors.
- 1 ea, mini-RC Servo.
- 1ea, book: *Programming and Customizing The Basic Stamp Computer*, by Scott Edwards.

Introduction:

Included with the Universal Stamp Board Kit is a book by Scott Edwards title*: Programming and Customizing the Basic Stamp Computer.* You must read this book to understand how to program and operate Basic Stamp chips. This manual merely explains how to apply what is taught in that book to the Universal Stamp Board.

Overview:

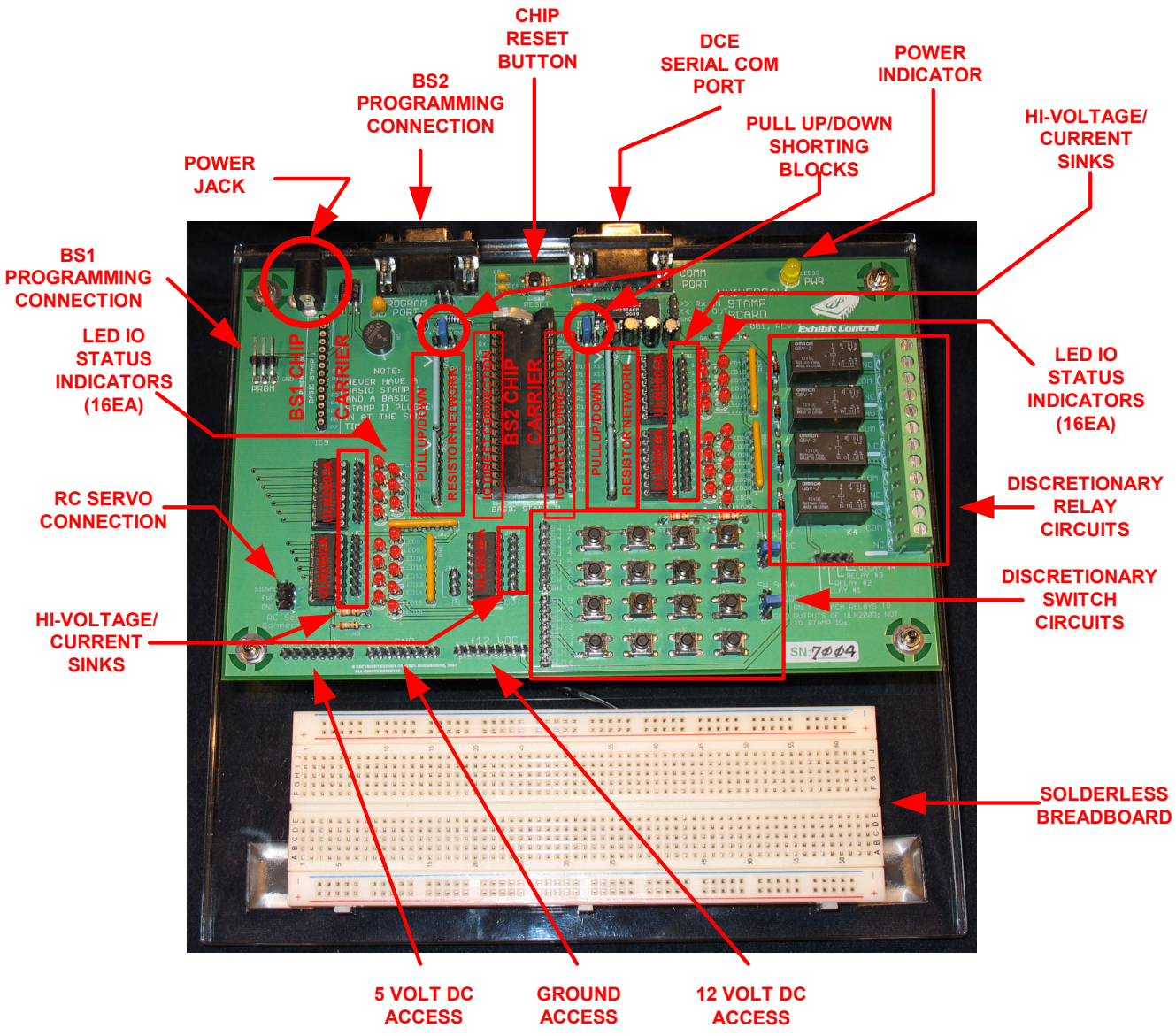

Figure 1. Universal Stamp Board Overview

The Basics:

- Installing Stamps: All of the following variants of Stamps can be used with Universal Stamp Development Board: BS1, BS2, BS2e, BS2sx, BS2p24, BS2p40, BS2pe and BS2px.

  WARNING: ***Do not install Stamp chips into their carriers when the circuit board has power applied to it. Remove power to install the Stamp chips.***

  - Installation of BS1:

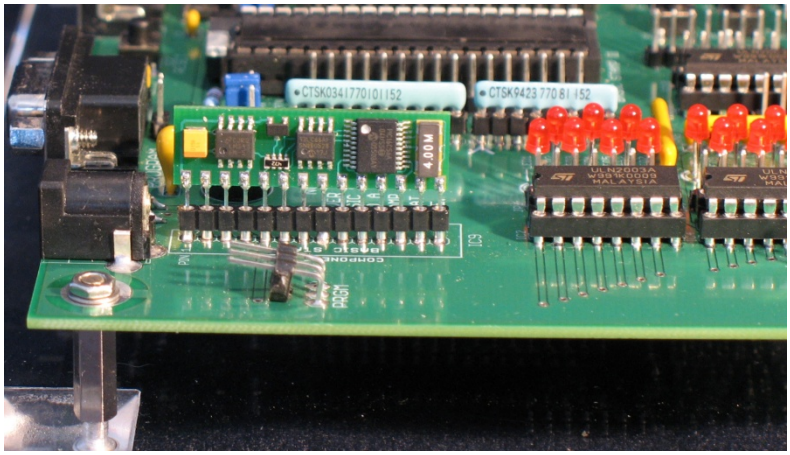

Figure 2. BS1 Installation

  - Installation of all 24-pin Stamp Variants:

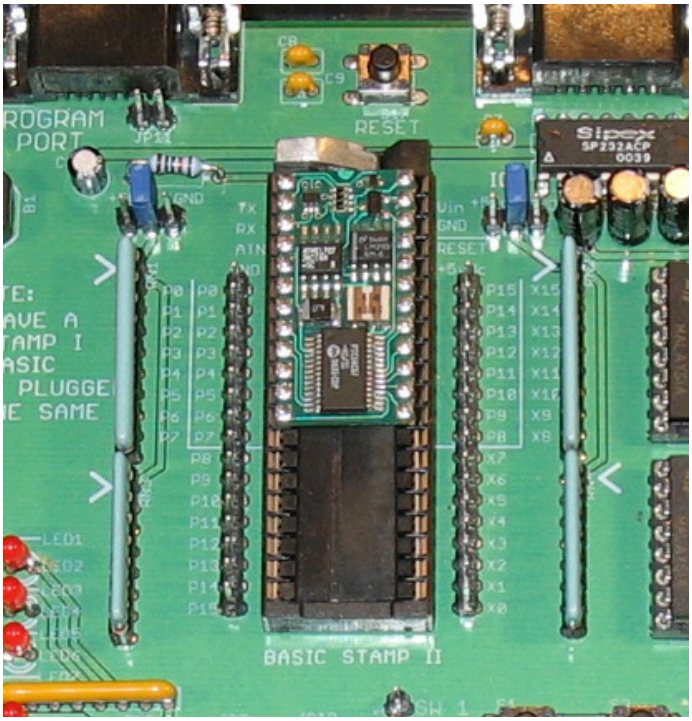

Figure 3. BS2 24-Pin Variant Installation

- Installation of all 40-pin Stamp Variants:

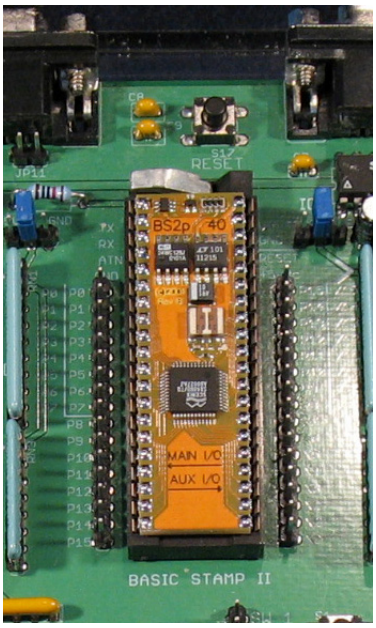

Figure 4. BS2 40-Pin Variant Installation

- Connecting Power: Apply 12 volts DC to the power jack in the upper left corner of the printed circuit board. The power jack on the board can use either polarity. See Figure 5.

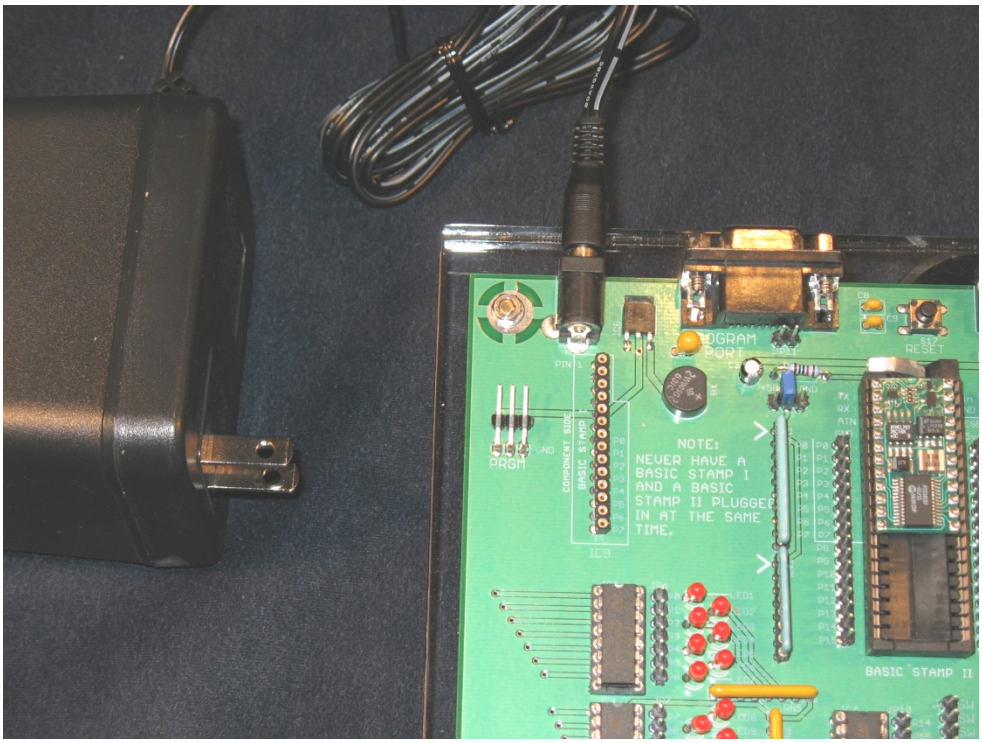

Figure 5. Connecting Power

- Programming a BS1:

  Connect the BS1 Serial Adapter to the program connector on the PCB. Connect a straight through serial cable from the adapter to the PC computer. Make sure the ground pin and the adapter pins marked with "<<" are on the same side. See Figure 6.

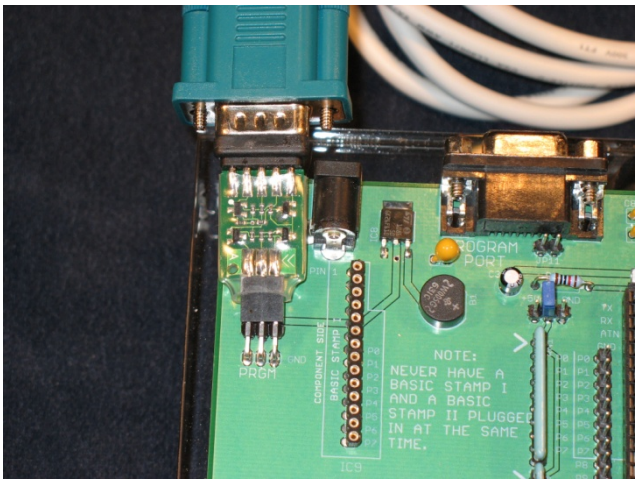

Figure 6. BS1 Programming Connection

- Programming BS2 (All Variants):

  Connect a straight through serial cable to the female DB-9 connector labeled "Program

Port" and the other end to the PC computer, See Figure 7.

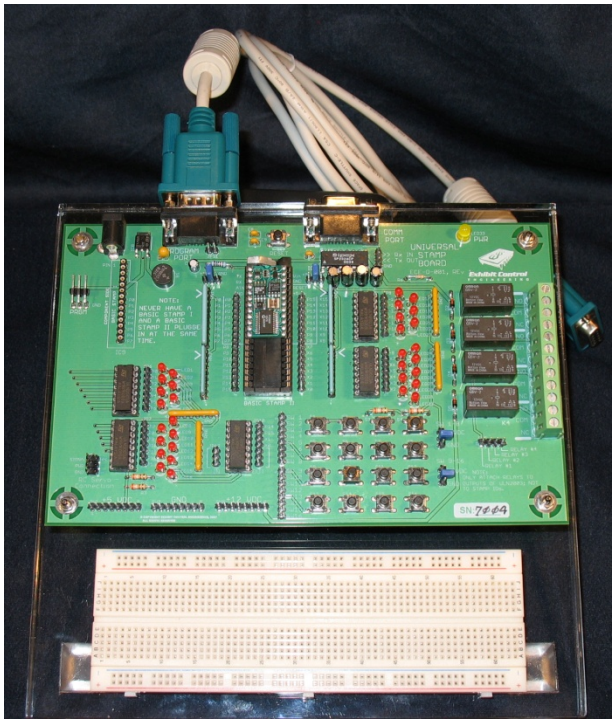

Figure 7. BS2 Programming Connection

- Installing Pull Up/Down Resistor Networks:

    - It is usually not a good idea to leave input IOs floating. To avoid this, connect a pull up/down resistor to an IO. For instance, if you want to have a contact closure device trigger an input, you will normally pull the input up to 5 volts and have the contact closure change its state to zero (or ground). The general circuit diagram for pull up/down resistor networks looks like Figure 8.

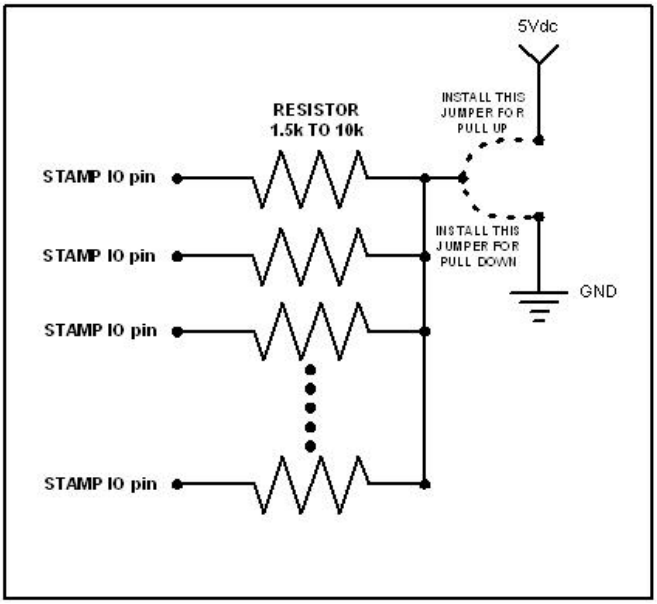

Figure 8. Pull Up/Down Circuit

This circuit shows a multi-resistor network that has one pin common to all resistors while the other side of each resistor has its own pin. This pin is tied directly to the Stamp IO. The common pin is either connected to 5 volts for pull up action or tied to ground for pull down action. The kit provides two nine-resistor networks and two seven-resistor network devices with sockets for each near the direct connection for each IO. There are two places with shorting blocks; one to tie the left side IOs to either 5vdc or ground and one for the right side IOs.

Generally all of one side IOs must have the same action: pull up or down or no resistor at all. However, you can use the seven-resistor network in the nine resistor slot so that only the first seven IOs on a side have pull resistor action, and the last two don't. You can also bend a resistor lead up so that it doesn't make contact to adjust for more flexible configurations. See Figure 9. However, there is a minimum number of times the lead can be bent before it will break off.

Suggestion: When prototyping a circuit put all one kind of IO on one side of the chip and another on the other side. Then when you design the actual printed circuit board, you can swap IO gates around to make it more practical for the printed circuit board layout.

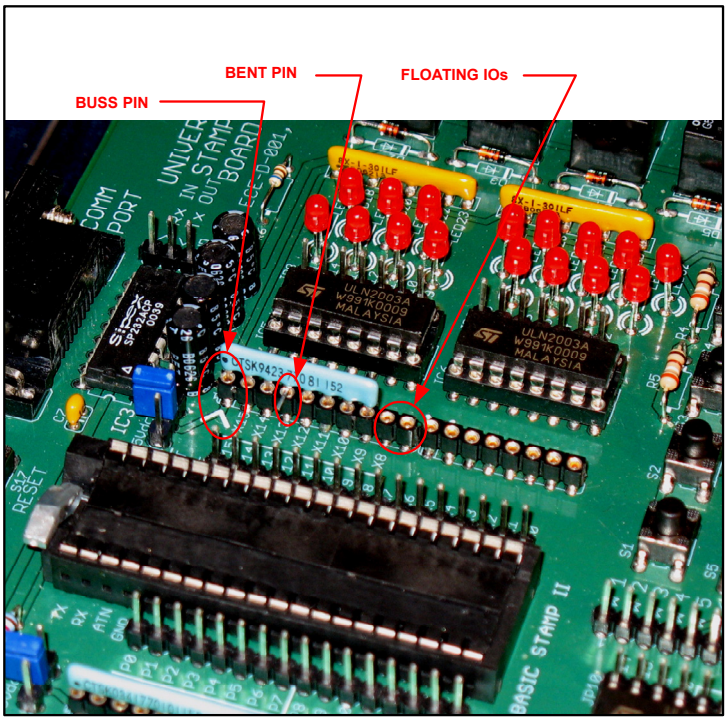

Figure 9. Alternative Resistor Network Connections

When installing the pull up/down resistor network it is important to ensure the buss pin is in the correct socket. The buss pin is indicated by a black dot at one end of the device. The printed circuit board has a ">" where this pin should mate. See Figure 10. Don't forget to install the jumper blocks on either five volts or GND.

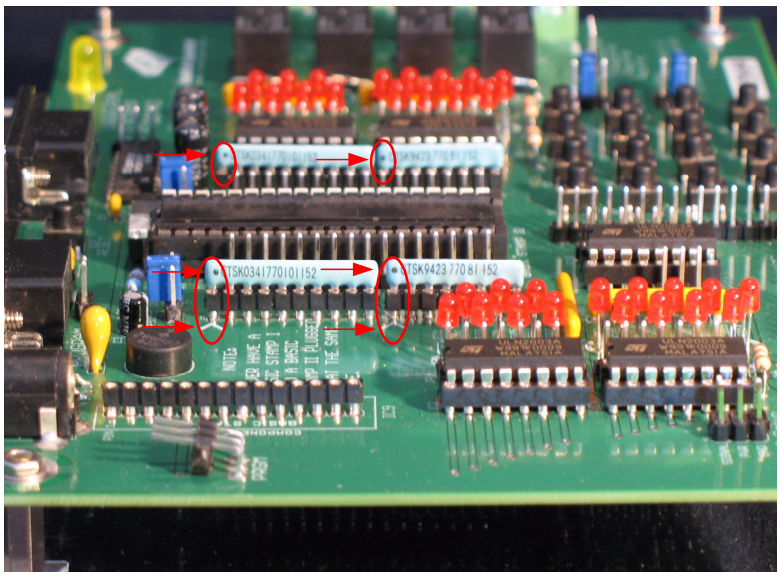

Figure 10. Resistor Network Orientation

- Using Discretionary Switches as IOs:

There are two switch arrays; each has eight switches for a total of 16 switches. Each set of switches has one contact common with the others which can be attached to either ground, 5 volts or some other signal via a jumper wire. The 5 volt and ground configurations are presented here.

First is the switch to Ground configuration. The circuit diagram looks like Figure 11.

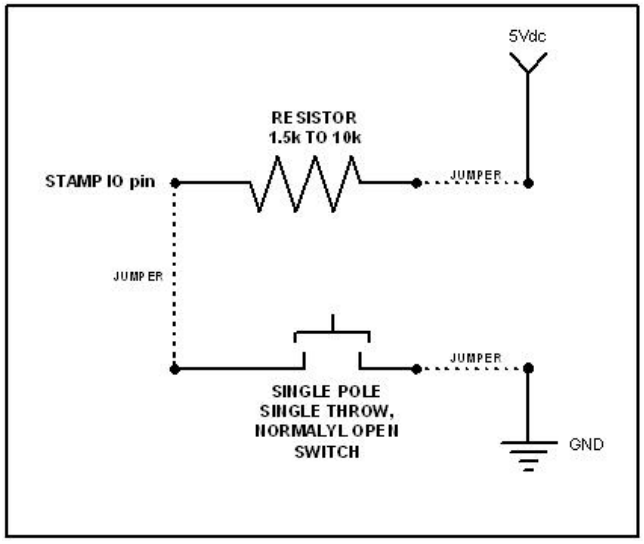

Figure 11. Switch to Ground

To accomplish this on the circuit board, see Figure 12.

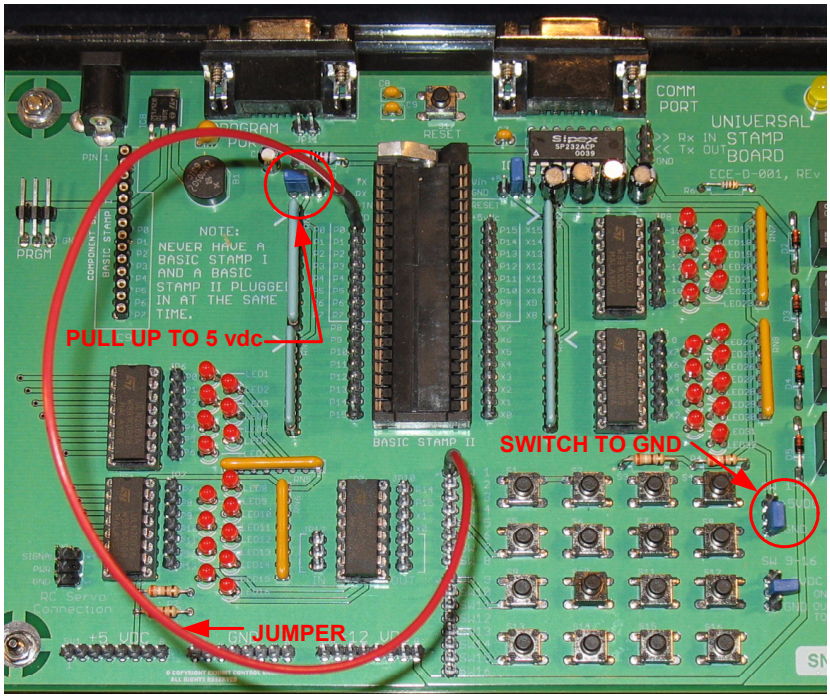

Figure 12. Switch to Ground Circuit Connections

To switch to high or 5 volts, see the circuit in Figure 13.

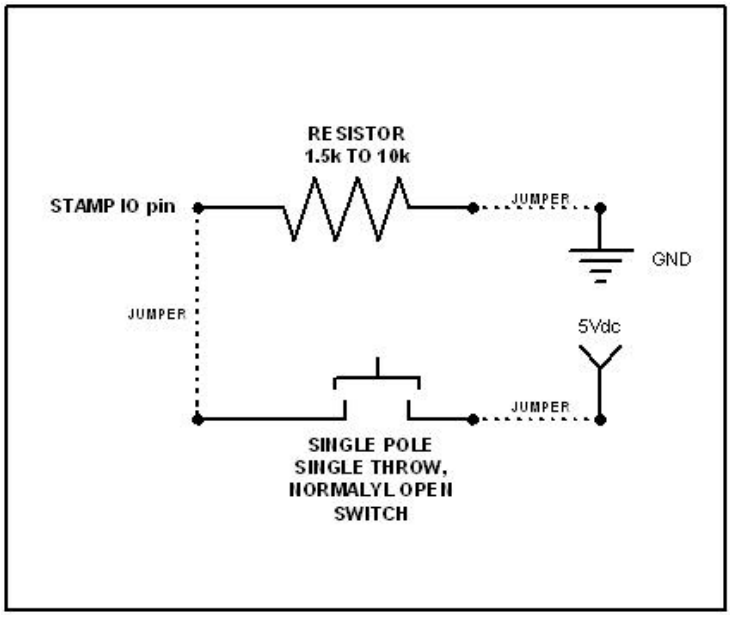

Figure 13. Switch to 5 Volts

To accomplish this on the circuit board, see Figure 14.

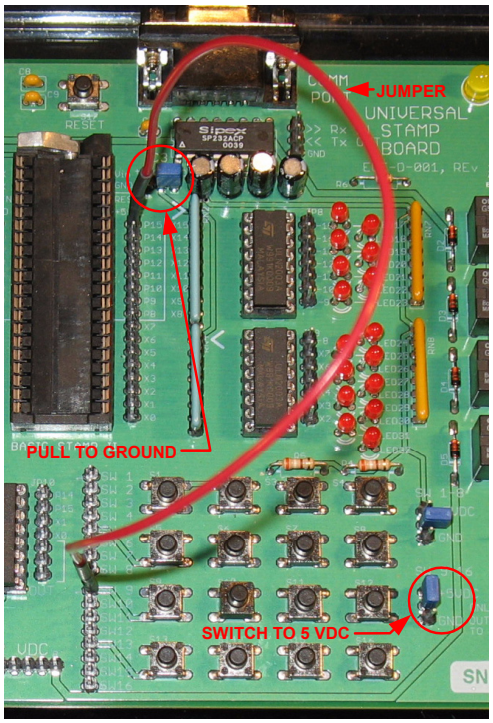

Figure 14. Switch to 5 Volts Circuit Connections

Some things to remember with switching circuits:

- All things being equal, it is better to switch to ground, especially in noisy circuits.
- If you are having problems with the logic of a switch, you may need to design a de-bounce circuit, provide a software de-bounce function or buffer the input with a Schmitt trigger.

- LED IO Indicator Status:

  All IOs, when used only as digital signals (that is: on or off), have the capability of having their status displayed by an LED. Although Stamp IOs can drive a LED directly, you need to observe the total IO output limitation is not exceeded. To alleviate this concern, the Universal Stamp Board uses a ULN2003A gate as a buffer between the IO and the LED. Therefore it is acceptable to have the ULN2003A installed anytime the IOs connected to it are strictly digital in nature. The LED will be on when the input or output is high and off when it is low. The ULN2003A should be removed from the circuit when one of its IOs is being used for communication signals or other complex functions.

ADVANCED TOPICS

- Integrating the Solderless Breadboard:

  Part of the Universal Stamp Board is a solderless breadboard on which a myriad of other electronic components can be mounted and integrated with the printed circuit board portion of the kit. Use jumper wires that are terminated on one end and stripped bare on the other to jumper signals between the two. Figure 15 shows how to provide 5 volt power to the breadboard using these jumper wires.

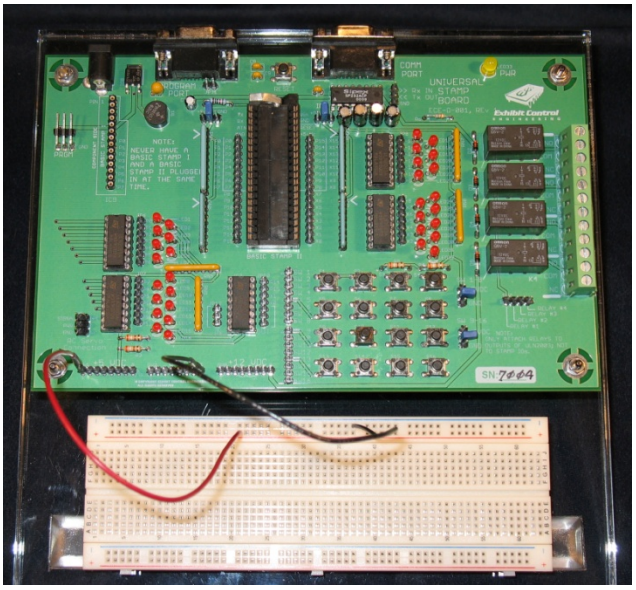

Figure 15. Powering Breadbaord

- Serial Communication Configuration:

  Stamps can be used to transmit and receive RS232 serial communications. Therefore, a chip is provided on-board to convert Stamp serial pulses to RS232 electrical signals. The port is configured as a DCE (transmit on pin 2 and receive on pin 3). This means you can use a straight through serial cable to communicate between the Stamp and a PC. To communicate between two Universal Stamp Boards, you would need a null modem adapter and a male gender changer to make the connection. You could use the Hyperterminal Program on your PC to communicate with the Stamp device. On the Resources disk there is another program called AV Terminal Commander II, which you can also use to communicate between a PC computer and a Stamp. See Figure 16 for RS232 connections.

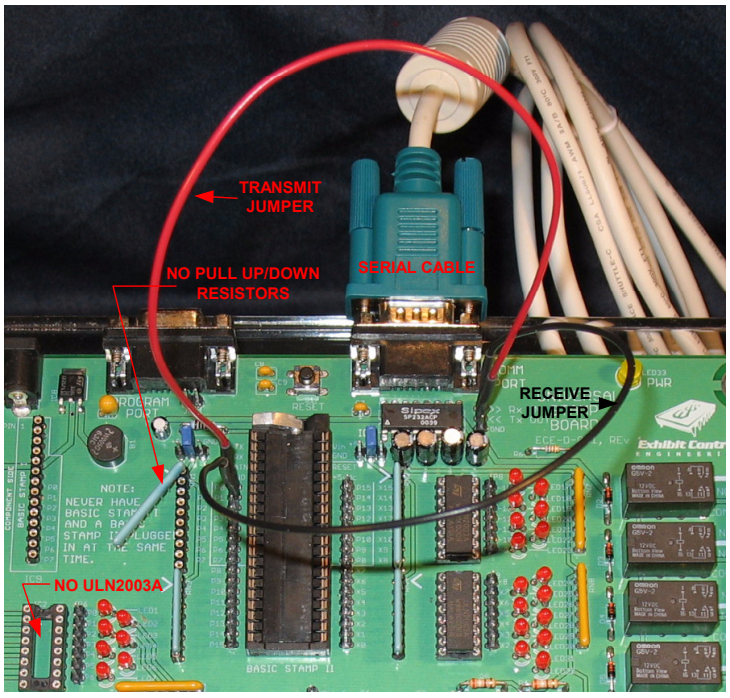

Figure 16. Serial Comm Connections

- RC Model Servo Connections:

  Stamps can also provide pulse width modulated signals to control radio control servos. There is a connection point on the printed circuit board and a mini servo is provided in the kit. Note: Do not try to drive a large torque servo from this connection. Large torque servos induce noise on the power busses which obliterates the servo signal. See Figure 17 for this configuration.

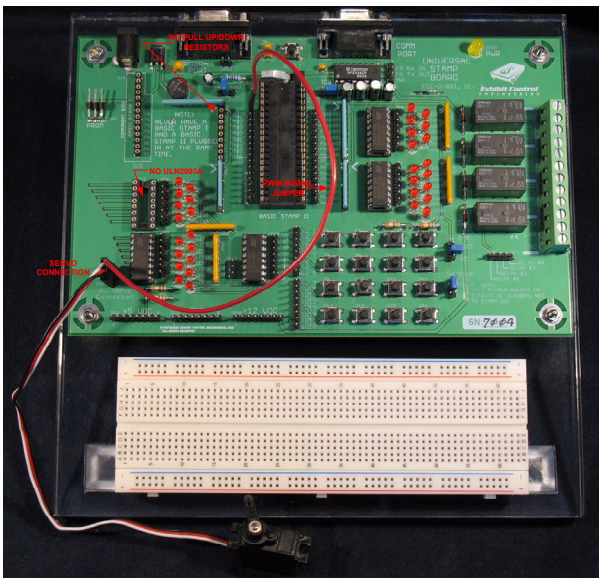

Figure 17. Servo Connections

- High Voltage/Current Output:

  Many times the circuits the Stamps are designed into need higher voltage and currents than is safe for the Stamps to operate with. All IOs have a ULN2003A gate provided for them to drive the LED status indicators. In addition to driving the LEDs, these gates can be used to sink as much as 500ma of current from sources up to 30VDC. Please note, these gates cannot create voltage outputs or source current, only sink current from voltage sources. The circuit diagram for these gates is seen in Figure 18.

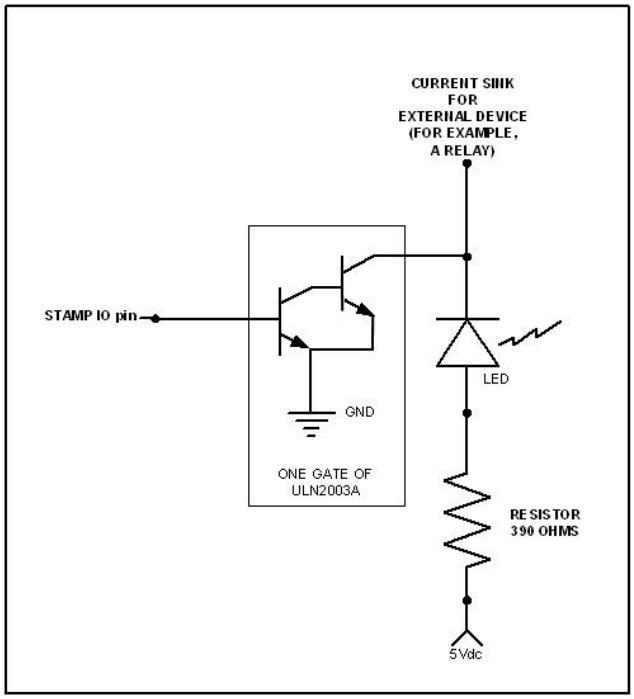

Figure 18. Hi-Voltage/Current Sink Circuit

- Relay Operations:

  For those times when there is a requirement for currents larger than 500ma or when voltages are needed, relays can be the answer. The Universal Stamp Board has four discretionary relays that can be used. These relays are driven by 12 VDC and currents which are larger than what Stamp IOs can handle.

  WARNING: ***Never connect relay coils directly to Stamp IOs; always use a ULN2003A current sink output.***

  See Figure 19 for illustration of how to connect the coils to ULN2003A outputs. Each of the relays has three terminals that can be attached to external circuits via screw terminals. There is a terminal that is normally closed to the common terminal and one that is normally open from the common terminal. When the relay is activated the normally closed and normally open terminals reverse states. These terminals are actually dual contacts tied together and are rated for 4 amps at 30vdc. Although the relays contacts are rated for 120vac, we do not recommend 120vac applications.

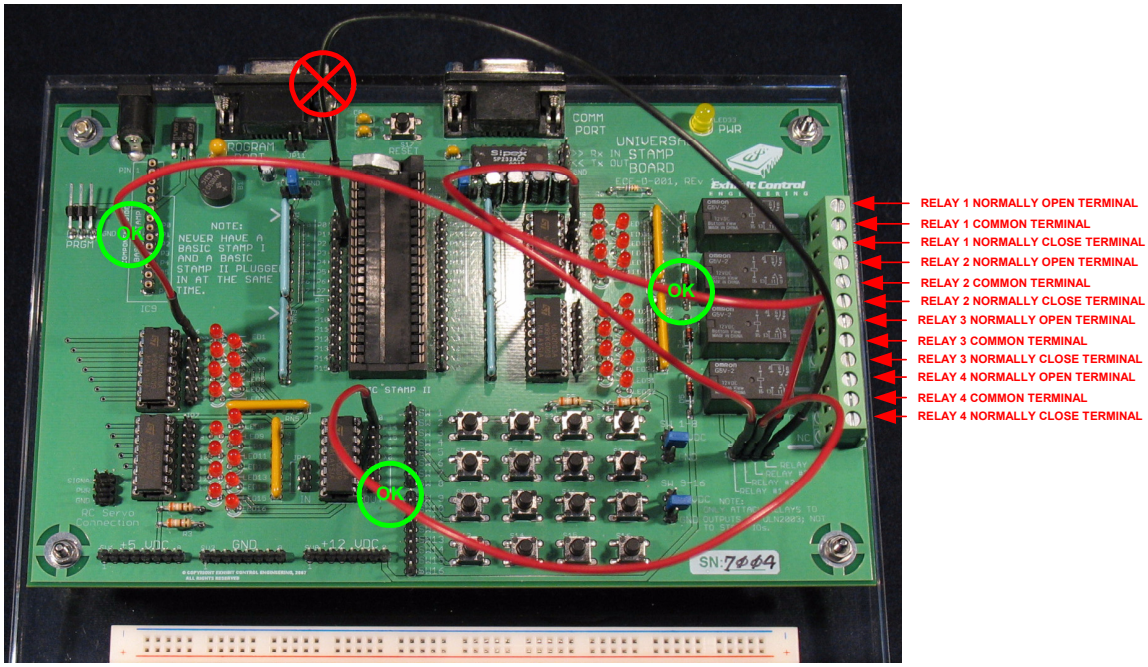

Figure 18, Relay Operations