HVW TECHNOLOGIES

a division of SOLARBOTICS

Stamp Stack II-SX

BASIC Programmable Microcontroller Kit

Quick and easy project prototyping for the Basic Stamp

- 100% BASIC Stamp 2-SX™ Compatible
- Reverse-polarity protected with indicator LED
- Serial connector and RESET switch built-in
- Solderless breadboard compatible
- Easily replaced Interpreter chip and EEPROM
- Runs on 5 to 12 volts DC
- Plugs onto any solderless breadboard
- Easy to assemble and use
- Ideal for Prototyping

www.hvwtech.com
www.solarbotics.com

SKU #25050
DocRev: July 15, 2008

This would be a blank page.
Make it your canvas and draw a masterpiece!

Thank-you for purchasing the Stamp Stack II-SX. You now own the most practical and useful BASIC microcontroller prototyping tool available. Plugging your Stamp Stack into a solderless breadboard gives you the flexibility to quickly build and test your designs.

CAUTION: This kit contains static-sensitive components that can be damaged or destroyed by improper handling. Anti-static mats and wrist straps are strongly recommended (see the HVWTech.com website). As a minimum, you should touch a grounded object (such as the screws on a light switch wall plate) before handling any component in this kit.

IT IS STRONGLY RECOMMENDED THAT YOU READ THIS ENTIRE MANUAL BEFORE ASSEMBLING THE KIT

A Note for Beginners

To build the Stamp Stack, you need to solder the components to the Printed Circuit Board (PCB). This manual presumes that you already know how to solder. If you do not, you can go to the below web address and download our free soldering tutorial for beginners:
http://www.hvwtech.com/resources.asp

Learning to solder is easy and just takes a little practice, but you might want to experiment with some pieces of wire and an old circuit board before jumping right into the kit. A 25-Watt pencil tip soldering iron (available from HVW Tech) is ideal for the job. But be warned - the soldering iron is HOT and WILL BURN YOU if not handled properly.

Options to Consider Before you Begin Building

The Stamp Stack can be built for use on a breadboard or as a stand-alone board. If you are just getting started, you will probably want to experiment with different circuits -and that is best done on a solderless breadboard. If you plan to build the Stamp Stack into a project or will not be using a breadboard, do not install the SIP headers (#'s 1 and 5 in Figure 1).

For battery-powered applications, the current drawn by the LED may be unacceptable (about 10 mA@12VDC). You can either replace the 1K resistor between the LED and the EEPROM (item #2 in Figure 1) with a larger value to reduce the current, or remove it completely (LED current will be zero and the LED will not light). For applications where current draw is not critical, install the supplied 1K Ohm resistor (recommended).

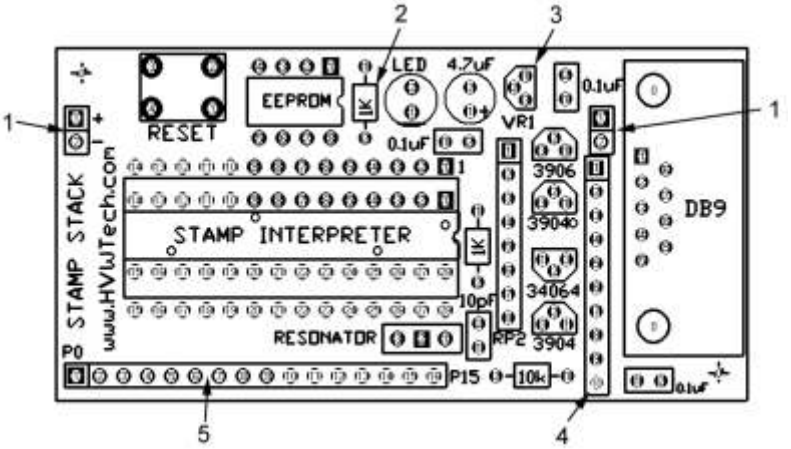


Figure 1: Component Layout

1 - 2-Pin SIP Headers [Power Inputs]
2 - Current-limiting Resistor for LED
3 - 2954 Voltage Regulator
4 - 10K, 10-Pin SIP Resistor
5 - 16-Pin SIP Header

Building the Stamp Stack II-SX

If you will be using your Stamp Stack on a breadboard, you will need to install the SIP Headers (#'s1 and 5 in Figure 1). These components are installed on the *bottom* of the board so it can be plugged onto a breadboard.

The best way to install the SIP headers is to mount them onto a breadboard and then place the circuit board on top (see Figure 2). Now quickly solder all the pins. This ensures that the pins will all be straight and the Stamp Stack will fit properly on your breadboard.

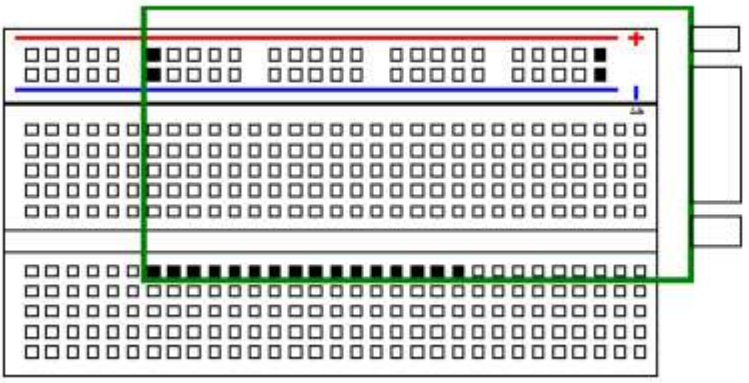


Figure 2: Mounting the Stamp Stack on a Breadboard

CAUTION: The breadboard is not designed to withstand much heat; solder each pin quickly so as not to overheat the breadboard.

Begin installing and soldering the components that sit closest to the PCB such as individual resistors and small capacitors. Continue with the SIP resistor packs, transistors, and the 4.7 µF capacitor (this part is polarity-sensitive; install it so that the pin with the "+" next to it goes in the hole with the "+" next to it). The LED is next and should sit such that the flat side (the side with the shorter leg) faces the middle of the board. Move next to the sockets, reset switch, DB-9 serial port connector and all other remaining components except the ICs (Stamp Interpreter and EEPROM).

IMPORTANT: Removing soldered-in components from the circuit board is not difficult but it is a skill that requires practice. If you are not completely comfortable with this process and/or do not have the appropriate tools then ask someone who does to help you or contact HVW Technologies. Once the circuit board is damaged, the kit is pretty-much junk.

Component Identification & Orientation

While most components will be easy to identify for anyone with some electronics experience (resistors, capacitor, etc.), we have taken some pictures of the components that might not be so obvious.

Figure 3 shows the four TO-92 package components showing the specific lettering on each device. From left to right, they are: 2N3904 (NPN) Transistor; 2N3906 (PNP) Transistor; MIC 2954 5-Volt LDO Regulator; and the 34064 Reset Circuit. Note that since more than one manufacturer makes versions of these parts, some of the lettering may be slightly different, but the part number will always be the same. Similarly, the colour of a component in your kit may be different than what is pictured in this document. With the exception of resistors whose coloured bands indicate the resistance, colour has no significance.

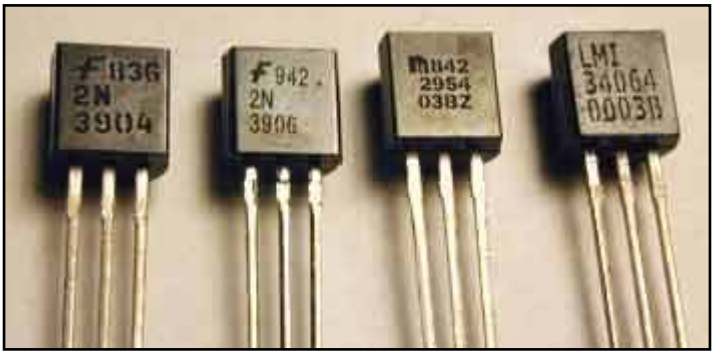


Figure 3: Transistors, Regulator, Reset Circuit

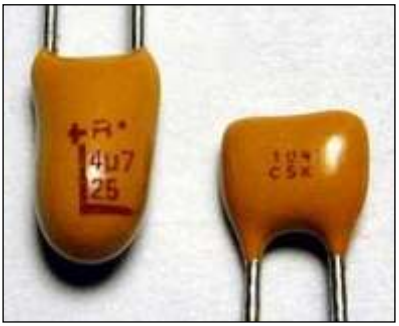


Figure 4: Capacitors

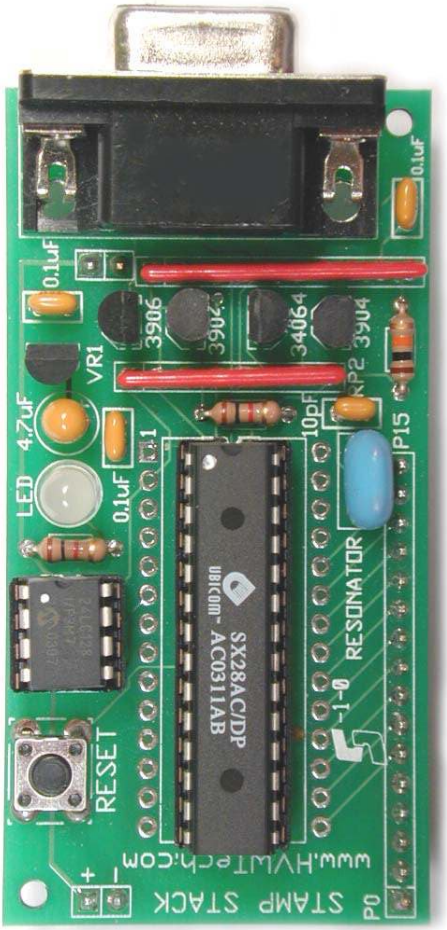
Figure 4 shows the two capacitors used on the Stamp Stack II Kit. On the left is the 4.7 uF Capacitor. This part is polarized which means is has to be put onto the circuit board in a certain way. In the photo, you can see a small "+" sign near the lead on the left; this lead must match with the hole with the "+" next to it on the circuit board. On the right is the 0.1 uF (104) capacitor; this capacitor is not polarized and can be inserted either way. There is third capacitor, a 10 pF cap, which looks just like the 0.1 uF shown here, but has "100" on it (instead of "104").

Figure 5: Resistor Packs

Figure 5 shows the 2 SIP resistor packs. On top is the 8-pin 4.7K pack, and on the bottom is the 10-Pin 10K pack. These components are also polarized, and pin (1) is identified with a dot, arrow or a line. In this case, you can see the arrow on the top/black resistor and the line on the bottom/red resistor.

A Picture is Worth 1000 Words

Check your board against the photo and look for any differences.



Stamp Stack II-SX

Checking Voltages

You will need to check the regulated +5 Volt supply on the board before installing the Interpreter Chip and EEPROM. In Figure 7 (on the next page), the arrows on the right show the output pin of the voltage regulator and the pin on the Interpreter Chip socket (pin 2). The Arrows on the left show the board ground and the ground pin on the Interpreter Chip socket (pin 4). The voltage between pin 4 and pin 2 should be between 4.8 and 5 Volts. The LED should be green when power is applied.

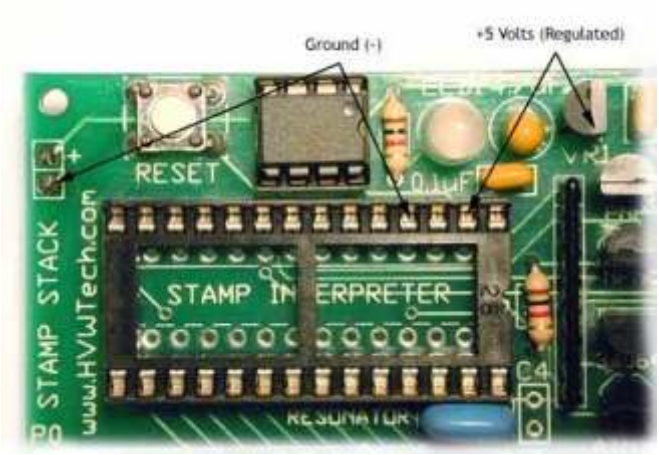


Figure 7: Powering the Stamp Stack 2

With the power ON, you should observe / measure the following:

1) LED is lit and is green (if it is red, you have the "+" and "-" from your power source reversed, or the LED is installed backwards [the flat of the LED should face the middle of the board]).
2) Between ground and Pin 1 of the regulator, you should measure your power supply voltage (+5 to +12 Volts DC)
3) Between ground and pin 3 of the regulator, you should see between 4.8 and 5 Volts.

Still not working?
If you've made it this far and your Stamp Stack still isn't working and you have:

- Checked all components for proper placement and orientation
- Checked your solder work for shorts or cold solder joints
- Had someone else check your work

…then you might need some technical support. Skip to page 14 for further details.

DO NOT CONTINUE UNTIL YOU GET A READING BETWEEN 4.8 AND 5 VOLTS DC

Remove power and carefully install the Interpreter and EEPROM chips into their sockets, making sure that the semi-circle notch on each chip is facing the DB-9 serial port connector.

Your Stamp Stack is now ready to use!

Using the Stamp Stack

Stamp Stacks behave exactly like BASIC Stamps –that's because they *are* BASIC Stamps; just in a different format. The same commands, programming (editor) software, cables etc. are used.

1. Mount your Stamp Stack to a breadboard and apply power (+5 to 12 Volts DC –we recommend 6 VDC as being ideal). The LED on the Stamp Stack should be green.

2. Connect a standard (straight through) serial cable between the Stamp Stack and an available serial port on your PC. If your PC does not have a serial port, HVW Tech has USB to RS-232 converters (Item # USB-001). Run the BASIC Stamp Editor software (available from the HVW Technologies website).

The following instructions assume you are using the Windows editor software v2.1 Beta 1. Be aware that there may be some differences if you are using another version.

3. Under the Run menu, select `Identify`, or simply click on the small "ID card" icon in the toolbar. The editor software will scan the available serial ports and identify all BASIC Stamps that it finds. A small window will list the COM Port, the Device Type, the Firmware Version, Loopback and Echo Status for each COM port. If all is well, it will say "BASIC Stamp 2-SX"; Version "v1.0"; Loopback "Yes"; Echo "Yes".

4. If you do not see your Stamp Stack listed on any port, then see the Troubleshooting section of this manual. NOTE: When the software scans the ports, it is communicating with the Stamp Interpreter Chip on the Stamp Stack board. Since this is the same chip as on the BS2-SX module (BS2SC-IC), it will report that it has found a "BASIC Stamp 2-SX" and NOT a "Stamp Stack II-SX". This is normal.

Your First Program

If you've programmed a BASIC Stamp before, you can skip this section. If you are new to the Stamp, then this section will step you through running a simple program from start to finish. Your first program will be to flash a Light Emitting Diode (LED) once per second. It's a simple program, but will serve to guide you through the programming process and confirm that your Stamp Stack is opertaing properly.

Parts Required

Stamp Stack II-SX, Breadboard, LED (any size, any colour), A resistor (220 Ohms to about 1K Ohm is fine), some wire.

Procedure

Build the circuit as shown in Figure 8. The LED should be oriented such that the cathode (the side with the flat) is on the left (connecting to the resistor. The resistor goes from the LED's cathode to ground (be sure that the ground rail is connected to the battery ground somewhere. The Anode (positive LED lead) connects to port 0 or P0 of the Stamp Stack II SX.

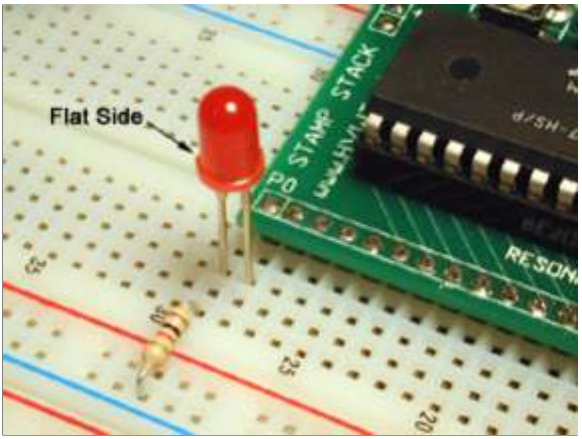


Figure 8: Circuit Hookup

Run the Stamp Editor and enter the following program:

```
'Flash1.BSX
'Flash and LED on and off once per second on P0

Loop:   High 0                  'Make Pin 0 HIGH (+5 Volts)
        Pause 1000              'Pause 1000 ms (1 second)
        Low 0                   'Make  Pin 0 LOW (0 Volts or Ground)
        Pause 1000              'Pause 1000 ms (1 second)
        Goto Loop       'Go back to Loop and do it again
END
```

Save the program as Flash1.BSX

We have shown all the comments in this program in blue. Comments start with an apostrophe (') and are used to make notes in the program so it is easier to understand. When the program is sent to the Stamp Stack, the comments are removed by the editor so they don't take-up any of the program space in memory. You should get into the habit of commenting all your Stamp programs; it will make your life much easier when you come back to a program several months later.

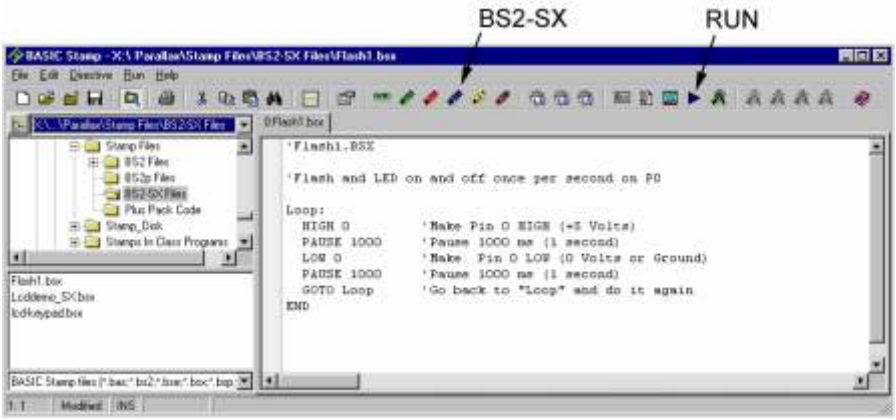


Figure 9: Stamp Editor

The screenshot in Figure 9 shows what your screen should look like when you've finished typing the program. NOTE: There may be small differences, depending on which version of the editor you are using. The editor software needs to be told which Stamp it is trying to program so click the blue BS2-SX chip in the tool bar. Notice how a line (called a 'directive') is inserted into the 1st line of your program to indicate that this is a Stamp 2-SX program.

Now program the Stamp Stack by clicking the RUN button. The editor will check for errors and, assuming none are found, will try to download your code into the Stamp Stack and run the program.

The LED on pin P0 should now be flashing. If it is not, be sure the LED is installed the right way around and is connected to P0. Check that the ground rail you are using is actually grounded.

If the editor produced an error, then you may have made a typo in your program. The editor will highlight the general area of the error; check that line carefully for spelling, spacing, missing quotation marks etc.

Congratulations ! You have successfully completed your first microcontroller program !

Going Further

Try experimenting with the program and re-loading it into the Stamp Stack. What happens if you change the Pauses to 100 ms ?

A 5-Volt Power Supply

The Stamp Stack has an on-board voltage regulator to supply the processor with +5 Volts. To protect the Stamp Stack from overload, this 5 Volt supply is not available to the user.

HVW Technologies makes a Breadboard Voltage Regulator (BVR) Kit (SKU#DT-01-007) that plugs right on to any breadboard. It can take power from a wall transformer or a battery and provide a stable +5 Volts DC at up to 1 Amp to power your Stamp Stack as well as any other circuitry on your breadboard. If you prefer, you can build your own by following the instructions below.

The 7805 regulator is a 1 Amp regulator that can accept up to 35 volts on its input and still supply a solid +5 Volt output. The 7805 is a very common part and is available at any electronics supply store, including Radio Shack. Due to the internal workings of the regulator, we need to provide at least 8 volts on the input so a 9 Volt battery makes an ideal power source. NOTE: Strange circuit behavior is often due to weak batteries !

Parts Required

7805 Positive 5 Volt Voltage Regulator
10 µF Electrolytic Capacitor (a larger value is fine)

Procedure

Build the circuit as shown in Figure 10 and 11. Be sure to install the capacitor with the negative stripe towards the centre (ground) pin of the 7805.

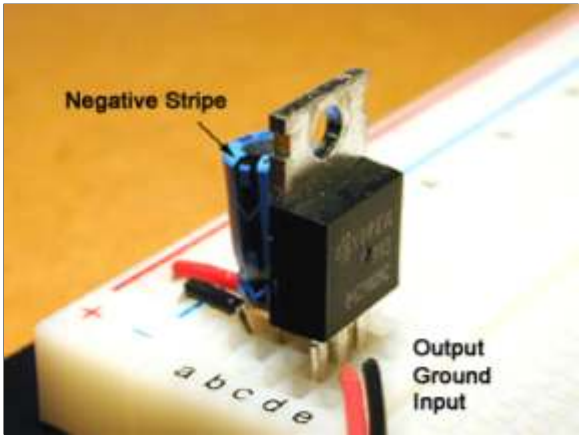


Figure 10: Voltage regulator, part one

Connect the output pin of the 7805 to the positive rail(s) of the breadboard; connect the ground pin to the negative rail(s) of the breadboard. Note that the output of the 7805 is about 4.95 Volts. Under normal circumstances, the Stamp Stack can be powered from this. However, it is best to connect the Stamp Stack directly to the 9 Volt battery and let the Stamp Stacks' on-board regulator generate its' own +5 Volts.

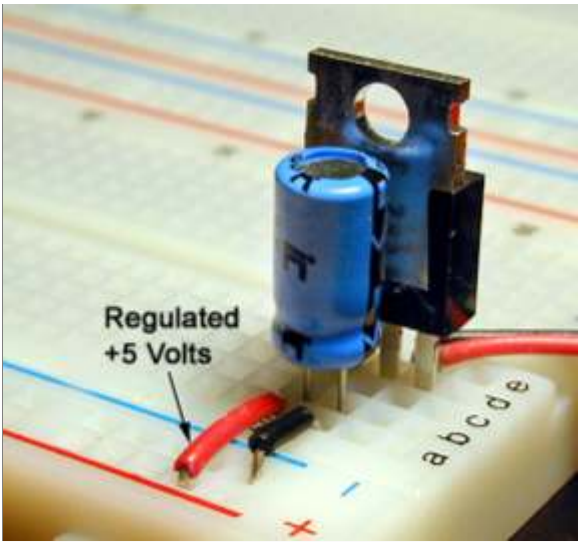


Figure 11: Voltage regulator, part two

Since the 7805 can supply 1 Amp of current @ +5 Volts, this supply should be plenty for most purposes. If your project is drawing much more than 100 mA or so, you may want to consider replacing the 9 Volt battery with a 9 Volt wall transformer (available from HVW Tech.) as the cost of 9 Volt batteries will soon add-up.

Limitations

Each I/O pin on the Stamp Stack (P0 through P15) can sink 25mA to ground or source 20mA (at 5 Volts). Internally, the 16 I/O pins are divided into 2 groups (P0 – P7 and P8 - P15). Each group cannot sink a TOTAL of more than 50 mA, or source more than 40 mA at the same time. Before connecting anything to a Stamp Stack pin, you should know how much current it draws. If the item draws more than the pin can handle, the Stamp Interpreter chip may be permanently damaged. You cannot, for example, directly connect a motor or a relay to a Stamp Stack pin; you *must* use a transistor that can handle the kind of current you need.

Troubleshooting

The error messages below assume you are using Stamp Editor v2.1 Beta 1. Error messages may be worded differently for other versions. Probable causes are listed in the order in which they are most likely to occur.

Symptom or Error Message	Probable Cause(s) / Solution(s)
LED doesn't light	-No power. Connect +5 to +12 VDC -Resistor (#2 in Figure 1) is missing. Install resistor.
LED Lights RED	-Polarity of power reversed. Correct polarity -LED installed backwards. Correct LED orientation (Flat of LED should face middle of PCB).
"Loopback" and "Echo" Status fields say "No" when you try to identify the Stamp.	-The serial link between the PC and the Stamp Stack is broken. Check that the serial cable is properly connected and is of the right type.
"Loopback" and "Echo" Status fields say "Yes" but "Device Type" and "Version" fields are blank when you try to identify the Stamp	-No power. Connect +5 to +12 VDC -Check for bad or missed solder joints -Missing or damaged Interpreter Chip
"Hardware Communications Failure –Check Serial Cable and Power Supply" error when trying to program the Stamp	-Missing or damaged EEPROM

IF YOU ARE HAVING PROBLEMS, USE THE "IDENTIFY" FEATURE
The identify feature provides much more information when trying to track down a problem. The errors reported when trying to program the Stamp Stack are not nearly as useful.

Technical Support

The Stamp Stack website is www.HVWTech.com/info/StampStack
The website has close-up photos of parts and finished Stamp Stacks. If you are having problems identifying components, building the Stamp Stack, or programming it, the website will give you the quickest answers.

Technical support is available if you are still having problems. If you need help, please provide as much detailed information as possible.

E-mail: support@hvwtech.com
Phone: (403) 730-8603 (Monday - Friday 9am – 5pm Mountain time)

**** Please contact us *before* sending a Stamp Stack for repair ! ****

The BASIC Stamp Mailing List

An excellent place to get project ideas, suggestions and information is on the BASIC Stamp mailing list. Hundreds of “Stampers” of varying abilities send and recieve messages related to BASIC Stamps each day. To subscribe, go to:

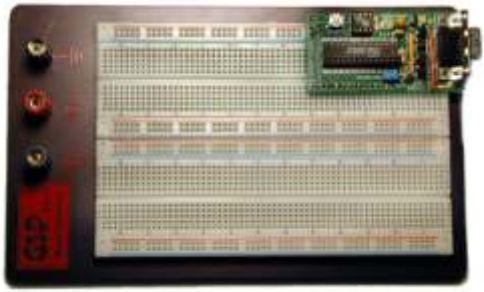
http://www.yahoogroups.com

Enter the word: “basicstamps” (without the quotes) into the search box on that page and click the SEARCH button. Click on the hyperlink that results and follow the prompts to subscribe.

Stamp Stack II-SX Parts List
(Qty) Description (Part #) [PCB Silkscreen description]
(1) Interpreter Chip (SX28AC/DP) [Stamp Interpreter]
(1) EEPROM (24WC128P) [EEPROM]
(1) Reset Switch (pushbutton) [RESET]
(1) 50 MHz Resonator [Resonator]
(1) Bi-Colour LED [LED]
(1) PNP Transistor (2N3906) [3906]
(2) NPN Transistors (2N3904) [3904]
(1) 5 Volt MCU Reset (34064) [34064]
(1) 4.7 µF Tantalum Capacitor (4µ7) [4.7µF]
(3) 0.1 µF Capacitors (104) [0.1 µF]
(1) +5 Volt Voltage Regulator (2954) [VR1]
(1) 10K, 10-Pin SIP Resistor Pack (Colour may vary)
(1) 4.7K, 8-Pin SIP Resistor Pack (Colour may vary)
(1) 10K Resistor (Brown-Black-Orange) [10K]
(2) 1K Resistors (Brown-Black-Red) [1K]
(1) 28-Pin Socket
(1) 8-Pin Socket
(1) DB-9 Serial Port Connector
(1) Printed Circuit Board (PCB)
(1) 16-Pin SIP Header
(2) 2-Pin SIP Headers
(1) 10pF Capacitor (100) [10pF]

BASIC Stamp Prototyping Made Easy!

No Special Programmer Required -Connects Directly to PC Serial Port



This Package Contains a Basic Stamp Stack II-SX Kit (PCB, all parts and instructions)
Build Time: Beginner: 60-90 min. Intermediate: 35-45 min. Expert: 25-35 min.

Other products from HVW Technologies:

Soldering Equipment: Irons, stations, desoldering pumps and solder

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