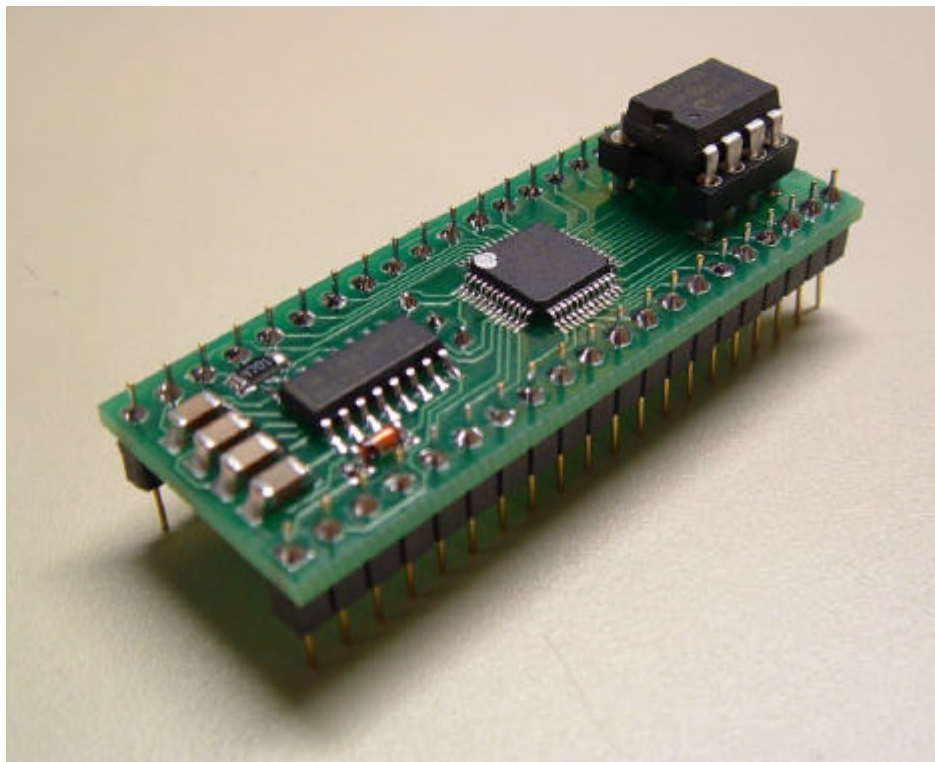


# BS2p40<sup>tm</sup> OEM Module

Surface mount/through hole kit



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Manual Revision .5

*NOTE:* The BASIC Stamp<sup>tm</sup> and the BS2p40 and Interpreter chip are trademarks of Parallax. This partial kit allows you to build a fully functional BASIC Stamp module using their OEM components (Interpreter chip, EEPROM, and resonator. Although the design is different, the finished module is compatible with the BS2p40 stamp in most instances. We are not affiliated with Parallax but offer this kit which complements their offering.

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## BS2p40 OEM module kit

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### INTRODUCTION

The BASIC Stamp is an extremely useful little micro controller that is easy to use in a variety of projects. For those projects that need extra I/O the BS2p40 module is an excellent choice since it offers 16 auxiliary I/O pins in addition to the 16 main I/O pins found on most other Stamp modules. The BS2p40 Interpreter chip itself is available from Parallax for those that wish to design their own boards. Although Parallax does offer an OEM kit for some of their Stamp Interpreter chips (through hole), there is nothing available for their surface mount versions like the BS2p40 interpreter chip. This kit fills that void for those few who would like to try building a surface mount kit and would like learn about and use these chips. This kit has been designed with a mix of surface mount and through hole components. The surface mount parts were selected so that they can be soldered with traditional hobbyist soldering equipment. No special equipment is required.

This module when finished should work just like a regular BS2p40 Stamp module in most instances. There are however, a few differences to note:

#### Disadvantages:

- This module is only available in kit form. It has to be built before using it. If you are looking for an assembled board, please purchase a BS2p40 Stamp directly from Parallax.
- This module is quite a bit taller and a little wider than the assembled BS2p40 Stamp module so physical space needs to be considered.
- This module uses a MAX232 for the Serial Interface and will not work if the Serial In and Serial Out lines are reversed. A regular BS2p40 Stamp module works if the Serial In and Serial Out are wired either way.
- Your user program is stored on the 8-pin DIP (EEPROM) that can be pulled out, read, and copied. Since the production module from Parallax has a surface mount chip, it makes this task more difficult as it would have to be unsoldered in order to read it.

#### Advantages:

- This module is only available in kit form and has to be built before using it. You get to learn some new surface mount soldering techniques and finally have a 3<sup>rd</sup> party design that validates that the BS2p40 OEM chip works!
- This module uses a MAX232 for the Serial Interface. It provides more of a true RS-232 standard signal and will theoretically be compatible with more Serial devices than the method used on the production BS2p40 Stamp module.
- Since the 8-pin DIP EEPROM can eventually wear out (faster with poor programming practices) it can easily be unplugged and replaced.
- The DIP form factor for the EEPROM enables it to be swapped out. You can download different programs into different EEPROM chips. Just change programs by swapping EEPROM chips instead of reprogramming. This could lead to experimentation with bank switching, etc. for even larger programs!

**NOTE:** This kit requires expert soldering skills to successfully complete. If you are unsure about building this kit, it is suggested that you purchase an assembled BS2p40 Stamp module from Parallax.

### CIRCUIT ASSEMBLY

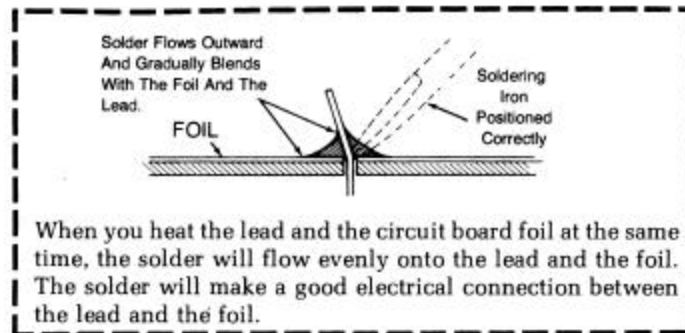
This kit should be built using standard construction methods. The following items are required to build the kit: diagonal cutter, needle nose pliers, tweezers, soldering iron (pencil type) with very fine tip, a good quality solder (60/40 Rosin core, RoHS, etc.), solder wick, liquid solder flux (optional), a magnifying glass, and some patience. Follow the instructions carefully and read the entire step before performing each operation.

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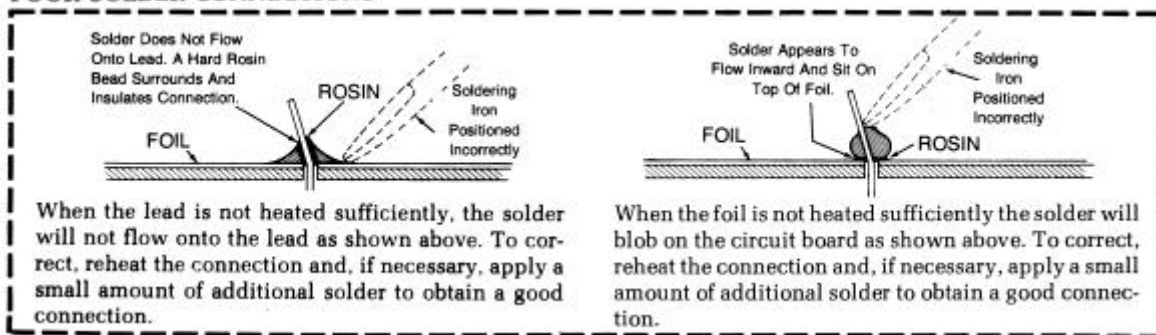
To successfully assemble this kit you must have good soldering skills. A good solder connection will form the electrical connection between two parts, such as a component lead and a circuit board foil. Care also needs to be taken to ensure that there are no solder bridges causing shorts. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

During assembly make sure you keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When the solder tends to “ball” or does not stick to the tip, the tip needs to be cleaned and retinned.

### A GOOD SOLDER CONNECTION



### POOR SOLDER CONNECTIONS



The top side of the board says “BS2P40OEM” on the right edge. During construction, components will be mounted on both sides of the board. The components soldered to the top of the board will be installed first. After installing each component at the specified location, solder it in place before proceeding to the next. When installing the DIP socket solder each of the two opposing corners first. Then gently press on the center of the socket while warming the solder on each of those corner pins with the soldering iron to make sure the socket is properly seated. Finally solder the rest of the leads on the socket. This method gives the board a much cleaner look than if the leads on the sockets have been folded over to hold it in place before soldering.

**NOTE:** The assembly instructions have been sequenced so that the installation of each component will not block the next one to be installed.

Components installed on the top of the PCB:

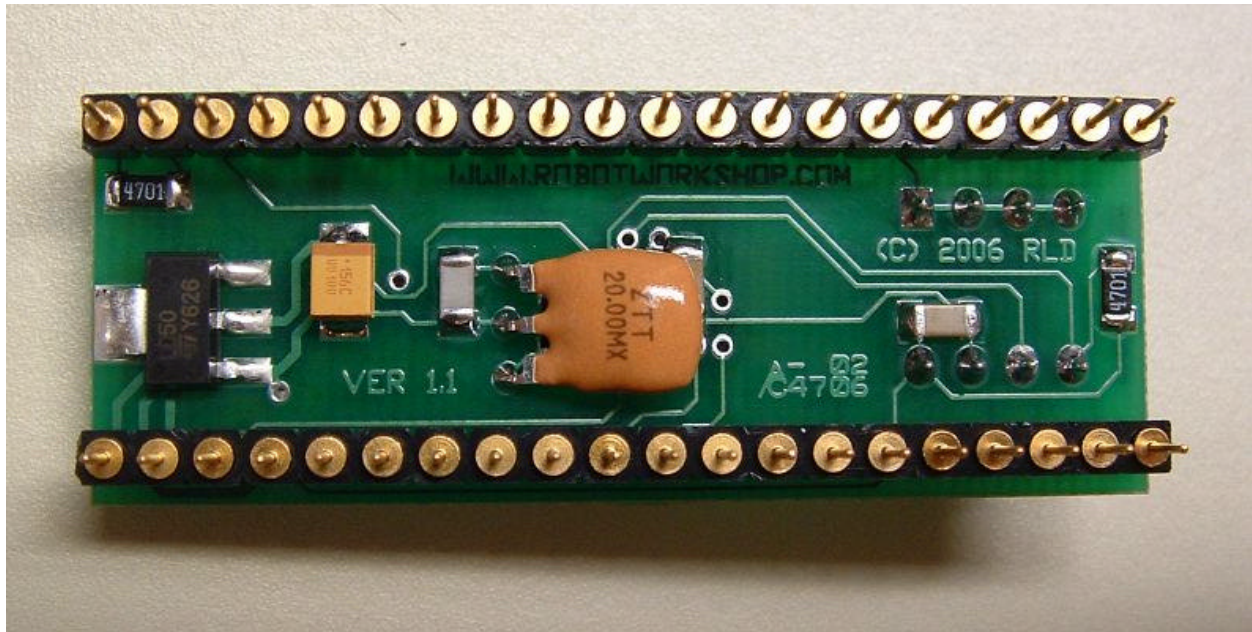
- Install the Parallax BS2p40 CPU on the top center. Pin one of the CPU should be orientated toward the left top of the board. The alignment of this part is critical. If the soldering iron is tinned it can warm one lead on the part to tack it in place. Once it is aligned the rest of the pins can be soldered.
- Install the MAX232D of the board near the left side. Pin one of MAX232D should be orientated toward the left top of the board. The alignment of this part is critical. If the soldering iron is tinned it

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can warm one lead on the part to tack it in place. Once it is aligned the rest of the pins can be soldered.

- Install the four 1.0 $\mu$ f (105) 1206 surface mount caps on their pads near the left edge of the board. These can be installed in either direction since polarity does not matter.
- Install the 4.7K  $\Omega$  (472 or 4701) 1206 surface mount resistor on the pads *just above the MAX232D* chip.
- Install the surface mount 4148 signal diode *just below the MAX232D, near the left of the board* at location **D801**. Place the band toward the left.
- Install the 8-pin DIP socket at location **U3**. The notch should point toward the left of the board.



Components installed on the bottom side of the PCB:

- Install the 5V ST-223 Voltage regulator at location **U4**. The large single tab goes toward the left near the edge of the board.
- Install the two .1 $\mu$ f (1206) surface mount caps. One is mounted directly under the CPU. The other is mounted next to pins 7 and 8 of the 8-pin DIP. These can be installed in either direction since polarity does not matter.
- Install the 5.1pf (1206) surface mount cap *just to the left of pads for the resonator*.
- Install the 10K  $\Omega$  (103 or 1002) 1206 surface mount resistor *just to the right of the pads for the resonator*.
- Install the two 4.7K  $\Omega$  (472 or 4701) 1206 surface mount resistors. One is mounted above the 5v regulator near the left side of the board. The other is mounted at the right edge near the middle.

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- Install the 15 $\mu$ f (156) surface mount capacitor (plastic rectangular box) just to the right of the 5v regulator. Observe the polarity as you do this! The stripe must be installed facing up. This is a tantalum capacitor and the proper polarity is critical.
- Install 20Mhz resonator. This can be installed on either side of the board. If installing it on the bottom side of the board it can be bent down against the board so it will be hidden underneath. This works well since there is extra clearance do to the plastic spacer holding the SIP pins together.

*NOTE:* When installing the headers insert the shorter leads into the PCB. The longer lead is where the configuration jumpers will go.

- Install the two 20-pin (1x20) from the bottom side of the board. Make sure the connector is perpendicular to the board. Proper alignment is critical since the module will not seat properly if these are not installed correctly.
- OPTIONAL:* De-flux and clean the board. This step is not required but when properly cleaned the board's appearance is better and it is easier to spot cold solder joints and solder bridges. Depending upon the type of flux used, this can be done economically using common rubbing alcohol and an old toothbrush.
- Install the 24LC128 EEPROM chip in the 8-pin DIP socket. The notch should point toward the left.

This concludes the Assembly procedures for the BS2P40OEM module. Congratulations! Before proceeding, look over the board and verify the correct location and orientation of all parts. Also check to make sure there are no solder bridges or poor solder joints. Some of the traces are very close together and it is easy to accidentally create a solder bridge across a trace or two.

## INSTALLATION AND OPERATION

This module conforms to the standard 40-pin BS2p40 for ease of use on breadboards and any place that it can be used. Since it uses a genuine Parallax PBASIC interpreter chip, this will work with all the standard BASIC Stamp development tools.

## SPECIFICATIONS

Main CPU: Parallax PBASIC48W/P40 (BS2p40)  
I/O: 16 Main I/O, 16 Auxiliary I/O, 1 Serial In, 1 Serial Out  
Power in: up to 12V unregulated  
Power: 5V LDO regulator .8A  
Serial Interface: More of a true RS-232 Interface via MAX232 chip.

## IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE
Module is not seen by the BS2p40 programming software	1. Check for solder bridges and cold solder joints. 2. Check orientation of tantalum capacitor.

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### Finished BS2p40 OEM module pinout

The following table shows the pinout for the finished BS2p40 OEM module. It lists the pin name as well as the description. An asterisk after the Mnemonic name means that the line is active low.

Pin #	Name	Definition	
1	SOUT	Serial data (from the BS2p40)	
2	SIN	Serial data (into the BS2p40)	
3	ATN	Attention – Used to reset module during programming	
4	VSS	Ground	
5	P0	Main I/O	
6	P1	Main I/O	
7	P2	Main I/O	
8	P3	Main I/O	
9	P4	Main I/O	
10	P5	Main I/O	
11	P6	Main I/O	
12	P7	Main I/O	
13	P8	Main I/O	
14	P9	Main I/O	
15	P10	Main I/O	
16	P11	Main I/O	
17	P12	Main I/O	
18	P13	Main I/O	
19	P14	Main I/O	
20	P15	Main I/O	
21	X0	Auxiliary I/O	
22	X1	Auxiliary I/O	
23	X2	Auxiliary I/O	
24	X3	Auxiliary I/O	
25	X4	Auxiliary I/O	
26	X5	Auxiliary I/O	
27	X6	Auxiliary I/O	
28	X7	Auxiliary I/O	
29	X8	Auxiliary I/O	
30	X9	Auxiliary I/O	
31	X10	Auxiliary I/O	
32	X11	Auxiliary I/O	
33	X12	Auxiliary I/O	
34	X13	Auxiliary I/O	
35	X14	Auxiliary I/O	
36	X15	Auxiliary I/O	
37	VDD	+5v out from regulator on module	
38	/RES	Module Reset	
39	VSS	Ground	
40	VIN	Unregulated power in (up to +12 VDC)	

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### REPLACEMENT PARTS LIST

#### Top of module

Quantity	Description	Location
1	BASIC Stamp BS2p40 Interpreter Chip (PBASIC48W/P40) ( This part is only available from Parallax – <a href="http://www.parallax.com/">http://www.parallax.com/</a> )	U1
1	MAX232D (surface mount)	U3
1	24LC128 (8-pin DIP format)	U2
1	8-pin DIP socket	U2
4	1.0µf surface mount capacitors – 1206	C1, C2, C3, & C4
1	4.7K Ω surface mount resistor – 1206	R1
1	4148 surface mount diode	D1
1	Custom PCB p/n BS2P40OEM	

#### Bottom of module

Quantity	Description	Location
1	5v LDO voltage regulator ST-223 package	U4
2	.1µf surface mount capacitors – 1206	C7, C8
1	5.1pf surface mount capacitor – 1206	C6
1	15µf surface mount tantalum capacitor – 1810 ??	C5
2	4.7K Ω surface mount resistors – 1206	R2, R4
1	10K Ω surface mount resistor – 1206	R3
1	20.00 MHz resonator (may be installed on bottom of module)	Y1
2	20-pin SIP machined pin M/M headers .100 inch	

#### Revision History

**Version 1.0** – Original Prototype. Required two slight modifications. One was to cut a trace and add a small surface mount signal diode inline with the SOUT line. The other was to cut a trace on the output of the MAX232 going to the /RESET line and add a 4.7K resistor inline.

**Version 1.1** - Current version. Has both corrections applied to the PCB layout.

#### REFERENCES

The Parallax Website:

<http://www.parallax.com/>

The Parallax BASIC Stamp™ forums:

<http://forums.parallax.com/forums/>

#### SPECIAL THANKS

A note of thanks to the folks over at Parallax for making the BASIC Stamp OEM chips available for sale and also the support on the Parallax forums during the design of the module.