

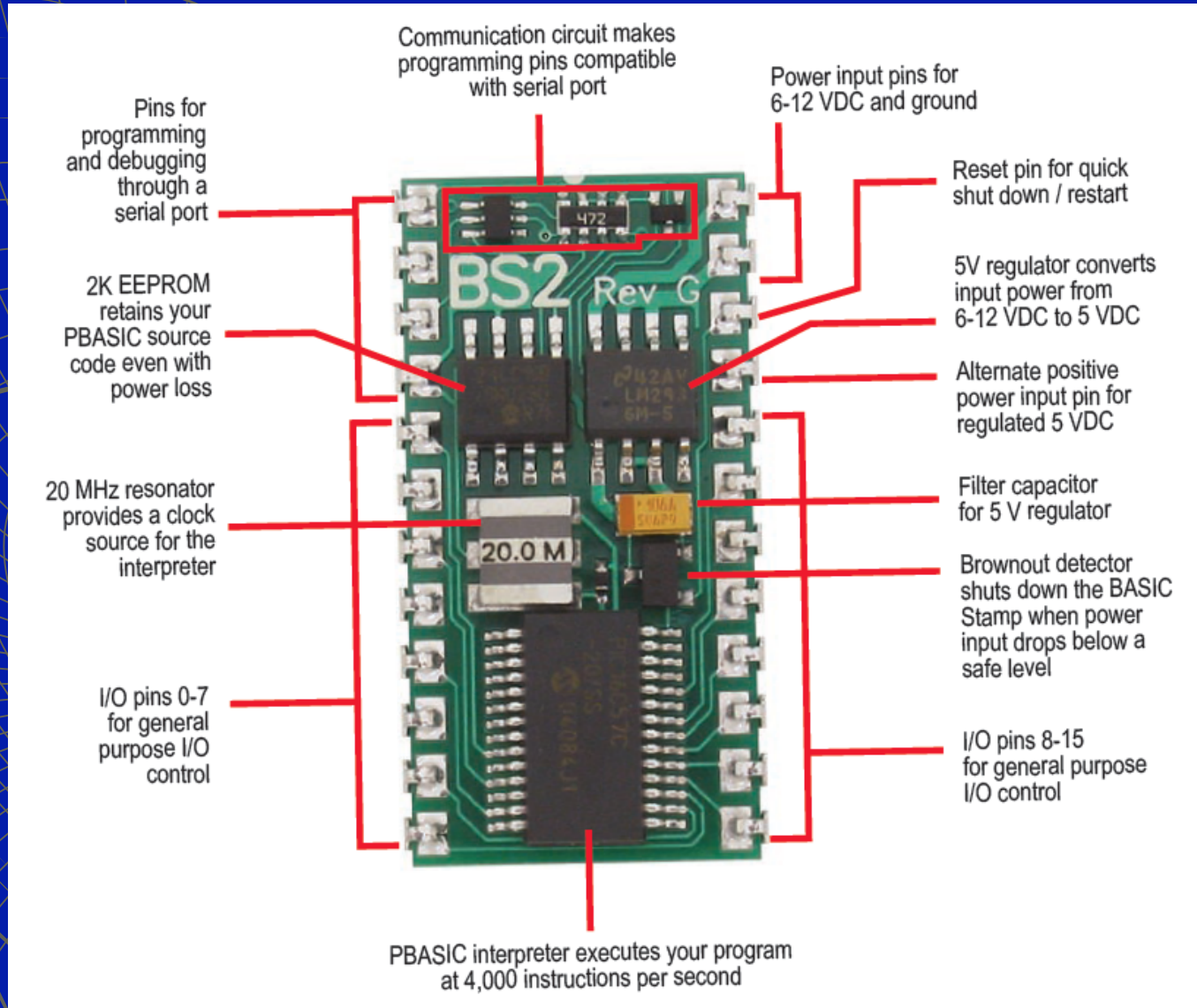
The University of Hong Kong

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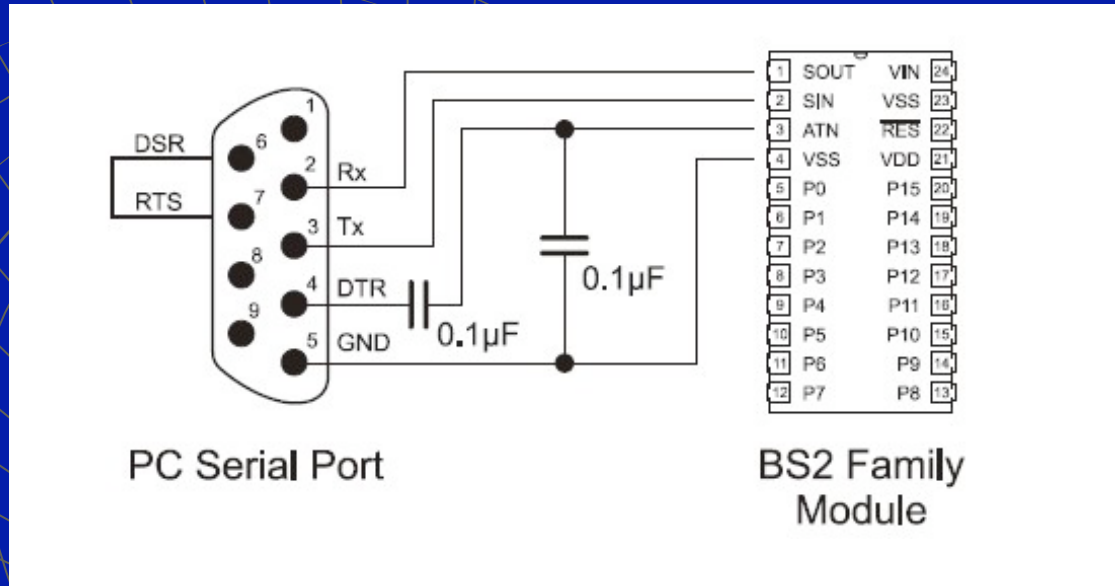
Department of Electrical  
and Electronic Engineering

Anemometer  
Design Competition  
(Micro-Controller)

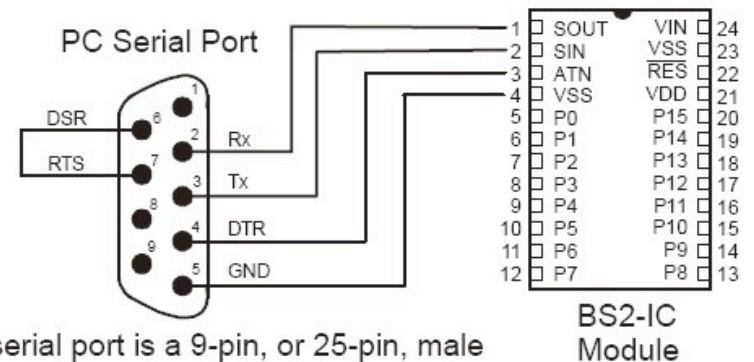
# Basic Stamp



# Download Cable

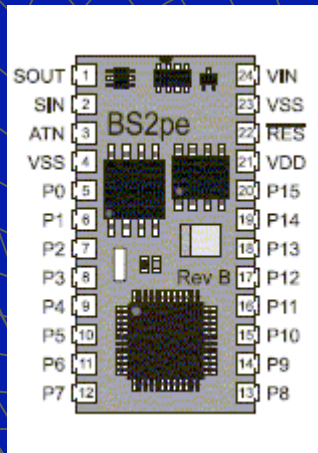


Connect DSR and RTS for automatic port detection.



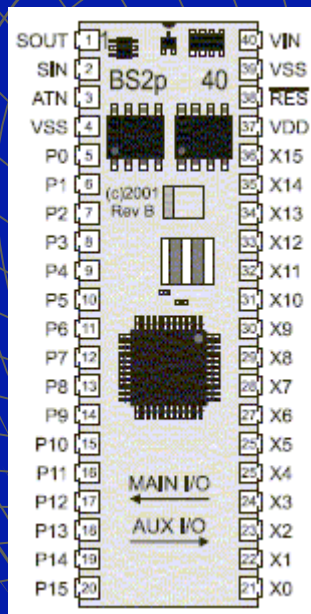
Note: The serial port is a 9-pin, or 25-pin, male connector, usually on the back of the computer. Use a 25-pin to 9-pin adapter when trying to interface to a 9-pin cable.

# Pin Assignment (DIP-24-Pin)



Pin	Name	Description
1	SOUT	Serial Out: connects to PC serial port RX pin (DB9 pin 2 / DB25 pin 3) for programming.
2	SIN	Serial In: connects to PC serial port TX pin (DB9 pin 3 / DB25 pin 2) for programming.
3	ATN	Attention: connects to PC serial port DTR pin (DB9 pin 4 / DB25 pin 20) for programming.
4	VSS	System ground: (same as pin 23) connects to PC serial port GND pin (DB9 pin 5 / DB25 pin 7) for programming.
5-20	P0-P15	General-purpose I/O pins: each can sink 25 mA and source 20 mA. However, the total of all pins should not exceed 50 mA (sink) and 40 mA (source) if using the internal 5-volt regulator. The total per 8-pin groups (P0 – P7 or P8 – 15) should not exceed 50 mA (sink) and 40 mA (source) if using an external 5-volt regulator.
21	VDD	5-volt DC input/output: if an unregulated voltage is applied to the VIN pin, then this pin will output 5 volts. If no voltage is applied to the VIN pin, then a regulated voltage between 4.5V and 5.5V should be applied to this pin.
22	RES	Reset input/output: goes low when power supply is less than approximately 4.2 volts, causing the BASIC Stamp to reset. Can be driven low to force a reset. This pin is internally pulled high and may be left disconnected if not needed. Do not drive high.
23	VSS	System ground: (same as pin 4) connects to power supply's ground (GND) terminal.
24	VIN	Unregulated power in: accepts 5.5 - 15 VDC (6-40 VDC on BS2-IC Rev. e, f, and g), which is then internally regulated to 5 volts. Must be left unconnected if 5 volts is applied to the VDD (+5V) pin.

# Pin Assignment (DIP-40-Pin)



Pin	Name	Description
1	SOUT	Serial Out: connects to PC serial port RX pin (DB9 pin 2 / DB25 pin 3) for programming.
2	SIN	Serial In: connects to PC serial port TX pin (DB9 pin 3 / DB25 pin 2) for programming.
3	ATN	Attention: connects to PC serial port DTR pin (DB9 pin 4 / DB25 pin 20) for programming.
4	VSS	System ground: (same as pin 23 on BS2p24, or pin 39 on BS2p40) connects to PC serial port GND pin (DB9 pin 5 / DB25 pin 7) for programming.
5-20	P0-P15	General-purpose I/O pins: each can source and sink 30 mA. However, the total of all pins (including X0-X15, if using the BS2p40) should not exceed 75 mA (source or sink) if using the internal 5-volt regulator. The total per 8-pin groups (P0 – P7, P8 – 15, X0 – X7 or X8 – X15) should not exceed 100 mA (source or sink) if using an external 5-volt regulator.
{21-36}	X0-X15	(BS2p40 Only!) Auxiliary Bank of General-purpose I/O pins: each can source and sink 30 mA. However, the total of all pins (including P0 – P15) should not exceed 75 mA (source or sink) if using the internal 5-volt regulator. The total per 8-pin groups (P0 – P7, P8 – 15, X0 – X7 or X8 – X15) should not exceed 100 mA (source or sink) if using an external 5-volt regulator.
21 {37}	VDD	5-volt DC input/output: if an unregulated voltage is applied to the VIN pin, then this pin will output 5 volts. If no voltage is applied to the VIN pin, then a regulated voltage between 4.5V and 5.5V should be applied to this pin.
22 {38}	RES	Reset input/output: goes low when power supply is less than approximately 4.2 volts, causing the BASIC Stamp to reset. Can be driven low to force a reset. This pin is internally pulled high and may be left disconnected if not needed. Do not drive high.
23 {39}	VSS	System ground: (same as pin 4) connects to power supply's ground (GND) terminal.
24 {40}	VIN	Unregulated power in: accepts 5.5 - 12 VDC (7.5 recommended), which is then internally regulated to 5 volts. Must be left unconnected if 5 volts is applied to the VDD (+5V) pin.

# Memory Mapping

Word Name	Byte Names	Nibble Names	Bit Names	Special Notes
INS	INL INH	INA, INB INC, IND	IN0 – IN7 IN8 – IN15	Input pins
OUTS	OUTL OUTH	OUTA, OUTB OUTC, OUTD	OUT0 – OUT7 OUT8 – OUT15	Output pins
DIRS	DIRL DIRH	DIRA, DIRB DIRC, DIRD	DIR0 – DIR7 DIR8 – DIR15	I/O pin direction control
W0	B0 B1			
W1	B2 B3			
W2	B4 B5			
W3	B6 B7			
W4	B8 B9			
W5	B10 B11			
W6	B12 B13			
W7	B14 B15			
W8	B16 B17			
W9	B18 B19			
W10	B20 B21			
W11	B22 B23			
W12	B24 B25			

Note: All registers are word, byte, nibble and bit addressable

# Operators

Operator	Description	Supported By:
+	Addition	All
-	Subtraction	All
*	Multiplication	All
**	Multiplication (returns upper 16-bits)	All
*/	Multiply by 8-bit integer, 8-bit fraction	All except BS1
/	Division	All
//	Modulus (Remainder of division)	All
MIN	Limits a value to a specified low	All
MAX	Limits a value to a specified high	All
DIG	Returns specified digit of number	All except BS1
<<	Shift bits left by specified amount	All except BS1
>>	Shift bits right by specified amount	All except BS1
REV	Reverse specified number of bits	All except BS1
&	Bitwise AND	All
	Bitwise OR	All
^	Bitwise XOR	All
&/	Logical AND NOT	Only BS1
/	Logical OR NOT	Only BS1
^/	Logical XOR NOT	Only BS1

# Command Reference

## BRANCHING / PROGRAM CONTROL

- |   |       |            |   |
|---|-------|------------|---|
| 1 | All 2 | BRANCH     | Jump to address specified by offset.              |
| 1 | All 2 | IF...THEN* | Conditionally execute one or more blocks of code. |
| 1 | All 2 | GOTO       | Jump to address.                                  |
| 1 | All 2 | GOSUB      | Jump to subroutine at address.                    |








## LOOPING STRUCTURES

- |       |                          |  |  |
|-------|--------------------------|--|--|
| All 2 | DO...LOOP <sup>2.5</sup> | Execute code block repetitively, with optional, conditional exit.      |  |
| All 2 | EXIT <sup>2.5</sup>      | Terminate execution of a looping code block (DO...LOOP or FOR...NEXT). |  |
| 1     | All 2                    | FOR...NEXT   | Execute code block repetitively, a finite number of times using a counter. |







# Command Reference

## EEPROM ACCESS




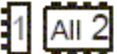
 EEPROM	Store data in EEPROM during program download.
 DATA	Store data in EEPROM during program download.
  READ*	Read EEPROM value into variable.
  WRITE*	Write value into EEPROM.
 STORE	Switch READ/WRITE access to different program slot.

## RAM ACCESS

  GET*	Read Scratch Pad RAM value into variable.
  PUT*	Write value into Scratch Pad RAM.









































# Command Reference

## NUMERICS

-  LET Optional instruction to perform variable assignments.
-  LOOKUP Look up data specified by offset and store in variable. This instruction provides a means to make a lookup table.
-  LOOKDOWN Find target's matching value in table and store match number (0-N) in variable.
-  RANDOM Generate a pseudo-random number.











# Command Reference

## DIGITAL I/O











 	CONFIGPIN	Configure pin properties.
 	INPUT	Make pin an input.
 	OUTPUT	Make pin an output.
 	REVERSE	Reverse direction of a pin.
 	LOW	Make pin output low.
 	HIGH	Make pin output high.
 	TOGGLE	Make pin an output and toggle state.
 	PULSIN	Measure width of an input pulse.
 	PULSOUT	Output a pulse by inverting a pin for a given amount of time.
 	BUTTON	Debounce button, perform auto-repeat, and branch to address if button is in target state.
	COUNT	Count cycles on a pin for a given amount of time.
	XOUT	Generate X-10 power line control codes.
  	AUXIO	Switch control to auxiliary I/O pin group.
  	MAINIO	Switch control to main I/O pin group.
  	IOTERM	Switch control to specified I/O pin group.
  	POLLIN	Specify pin and state for a polled-interrupt.
  	POLLOUT	Specify pin and state for output upon a polled-interrupt.
  	POLLMODE	Specify the polled-interrupt mode.

# Command Reference

## ASYNCHRONOUS SERIAL I/O










 	SERIN	Input data in an asynchronous serial stream.
 	SEROUT	Output data in an asynchronous serial stream.
  	OWIN	Input data from a 1-wire device.
  	OWOUT	Output data to a 1-wire device.

## SYNCHRONOUS SERIAL I/O






 	SHIFTIN	Shift data in from synchronous serial device.
 	SHIFTOUT	Shift data out to synchronous serial device.
  	I2CIN	Input data from I <sup>2</sup> C serial device.
  	I2COUT	Output data to I <sup>2</sup> C serial device.

# Command Reference

## PARALLEL I/O






  	LCDCMD	Write a command to an LCD.
  	LCDIN	Read data from an LCD.
  	LCDOUT	Write data to an LCD.

## ANALOG I/O




 	PWM	Output using pulse width modulation, then return pin to input.
	POT	Read a 5 k $\Omega$ - 50 k $\Omega$ potentiometer and scale result.
	RCTIME	Measure a variable resistance or capacitance.
	COMPARE	Compare two 0-5 V analog voltages.

# Command Reference

## TIME







-   PAUSE      Pause execution for 0–65535 milliseconds.
-    POLLWAIT      Pause until a polled-interrupt occurs.

## SOUND




-  SOUND      Generate tones or white noise.
-  FREQOUT      Generate one or two sine waves of specified frequencies.
-  DTMFOUT      Generate DTMF telephone tones.

# Command Reference

## POWER CONTROL

- |   |  |
|---|--|
|   NAP   | Nap for a short period. Power consumption is reduced.                          |
|   SLEEP | Sleep for 1-65535 seconds. Power consumption is reduced.                       |
|   END   | Sleep until the power cycles or the PC connects. Power consumption is reduced. |

## PROGRAM DEBUGGING

- |   |   |
|---|---|
|   DEBUG | Send information to the PC for viewing in the Debug Terminal's Receive windowpane.                    |
|  DEBUGIN <sup>2.5</sup>  | Retrieve information from the user via the PC, entered into the Debug Terminal's Transmit windowpane. |

# Body Comparison

Stamp Specifications (revised 04/05)

Released Products	Rev.Dx / BS1-IC	BS2-IC	BS2e-IC	BS2sx-IC
Package	PCB w/Proto / 14-pin SIP	24-pin DIP	24-pin DIP	24-pin DIP
Package Size (L x W x H)	2.5" x 1.5" x .5" / 1.4" x .6" x .1"	1.2" x 0.6" x 0.4"	1.2" x 0.6" x 0.4"	1.2" x 0.6" x 0.4"
Environment *	0° - 70° C (32° - 158° F) **	0° - 70° C (32° - 158° F) **	0° - 70° C (32° - 158° F)	0° - 70° C (32° - 158° F)
Microcontroller	Microchip PIC16C56a	Microchip PIC16C57c	Ubicom SX28AC	Ubicom SX28AC
Processor Speed	4 MHz	20 MHz	20 MHz	50 MHz
Program Execution Speed	~2,000 instructions/sec.	~4,000 instructions/sec.	~4,000 instructions/sec.	~10,000 instructions/sec.
RAM Size	16 Bytes (2 I/O, 14 Variable)	32 Bytes (6 I/O, 26 Variable)	32 Bytes (6 I/O, 26 Variable)	32 Bytes (6 I/O, 26 Variable)
Scratch Pad RAM	N/A	N/A	64 Bytes	64 Bytes
EEPROM (Program) Size	256 Bytes, ~80 instructions	2K Bytes, ~500 instructions	8 x 2K Bytes, ~4,000 inst.	8 x 2K Bytes, ~4,000 inst.
Number of I/O pins	8	16 + 2 Dedicated Serial	16 + 2 Dedicated Serial	16 + 2 Dedicated Serial
Voltage Requirements	5 - 15 vdc	5 - 15 vdc	5 - 12 vdc	5 - 12 vdc
Current Draw @ 5V	1 mA Run / 25 µA Sleep	3 mA Run / 50 µA Sleep	25 mA Run / 200 µA Sleep	60 mA Run / 500 µA Sleep
Source / Sink Current per I/O	20 mA / 25 mA	20 mA / 25 mA	30 mA / 30 mA	30 mA / 30 mA
Source / Sink Current per unit	40 mA / 50 mA	40 mA / 50 mA per 8 I/O pins	60 mA / 60 mA per 8 I/O pins	60 mA / 60 mA per 8 I/O pins
PBASIC Commands***	32	42	45	45
PC Programming Interface	Serial (w/BS1 Serial Adapter)	Serial (9600 baud)	Serial (9600 baud)	Serial (9600 baud)
Windows Text Editor	Stampw.exe (v2.1 and up)	Stampw.exe (v1.04 and up)	Stampw.exe (v1.096 and up)	Stampw.exe (v1.091 and up)

Released Products	BS2p24-IC	BS2p40-IC	BS2pe-IC	BS2px-IC	Javelin Stamp
Package	24-pin DIP	40-pin DIP	24-pin DIP	24-pin DIP	24-pin DIP
Package Size (L x W x H)	1.2" x 0.6" x 0.4"	2.1" x 0.6" x 0.4"	1.2" x 0.6" x 0.4"	1.2" x 0.6" x 0.4"	1.24" x 0.60" x 0.45"
Environment *	0° - 70° C (32° - 158° F)	0° - 70° C (32° - 158° F)	0° - 70° C (32° - 158° F)	0° - 70° C (32° - 158° F)	0° - 70° C (32° - 158° F)
Microcontroller	Ubicom SX48AC	Ubicom SX48AC	Ubicom SX48AC	Ubicom SX48AC	Ubicom SX48AC
Processor Speed	20 MHz Turbo	20 MHz Turbo	8 MHz Turbo	32 MHz Turbo	25 MHz Turbo
Program Execution Speed	~12,000 instructions/sec.	~12,000 instructions/sec.	~6,000/sec.	~19,000 instructions/sec.	~8,500 instructions/sec.
RAM Size	38 Bytes (12 I/O, 26 Variable)	38 Bytes (12 I/O, 26 Variable)	38 Bytes (12 I/O, 26 Variable)	38 Bytes (12 I/O, 26 Variable)	32768 Bytes
Scratch Pad RAM	128 Bytes	128 Bytes	128 Bytes	128 Bytes	N/A
EEPROM (Program) Size	8 x 2K Bytes, ~4,000 inst.	8 x 2K Bytes, ~4,000 inst.	16 x 2K Bytes (16 K for source)	8 x 2K Bytes, ~4,000 inst.	32768 Bytes
Number of I/O pins	16 + 2 Dedicated Serial	32 + 2 Dedicated Serial	16 + 2 Dedicated Serial	16 + 2 Dedicated Serial	16
Voltage Requirements	5 - 12 vdc	5 - 12 vdc	5 - 12 vdc	5 - 12 vdc	5 - 24 vdc
Current Draw @ 5V	40 mA Run / 350 µA Sleep	40 mA Run / 350 µA Sleep	15 mA Run / 36 µA Sleep	55 mA Run / 450 µA Sleep	80 mA Run / No Sleep
Source / Sink Current per I/O	30 mA / 30 mA	30 mA / 30 mA	30 mA / 30 mA	30 mA / 30 mA	30 mA / 30 mA
Source / Sink Current per unit	60 mA / 60 mA per 8 I/O pins	60 mA / 60 mA per 8 I/O pins	60 mA / 60 mA per 8 I/O pins	60 mA / 60 mA per 8 I/O pins	60 mA / 60 mA per 8 I/O pins
PBASIC Commands***	61	61	61	63	0 (Java)
PC Programming Interface	Serial (9600 baud)	Serial (9600 baud)	Serial (9600 baud)	Serial (19200 baud)	Serial (28800 baud)
Windows Text Editor	Stampw.exe (v1.1 and up)	Stampw.exe (v1.1 and up)	Stampw.exe (v1.33 and up)	Stampw.exe (v2.2 and up)	Javelin Stamp IDE

\* 70% Non-Condensing Humidity

\*\* Industrial Models Available, -40° - 85° C (-40° - 185° F). Contact Parallax Sales for information.

\*\*\* Using PBASIC 2.5 for BS2-type models.



# Reference Download

PARALLAX [www.parallax.com](http://www.parallax.com)  
Mind Research (HK Distributor) [www.mindresearch.com](http://www.mindresearch.com)

Basic Stamp  
[www.parallax.com/tabid/295/Default.aspx](http://www.parallax.com/tabid/295/Default.aspx)

BASIC Stamp Windows ver#2.4  
<http://www.parallax.com/tabid/441/Default.aspx>

## Documentation

- BASIC Stamp Syntax and Reference Manual Version 2.2
- StampWorks Manual v2.1
- BASIC Stamp 2p: Commands, Features, and Projects