

Akit-BASIC Stamp2SX

BASIC Stamp2SX / i-Stamp microcontroller Activity Kit

1. Kit Contents

In standard package of Akit-BASIC Stamp2SX include :

1. i-Stamp board	x 1
2. AX-2SX activity board	x 1
3. CX-232 serial port cable	x 1
4. SLCD16x2 Serial LCD module	x 1
5. Uni-polar stepper motor	x 1
6. Documentation	x 1
7. CD-ROM	x 1

To run this activity kit you'll need : DC adaptor +9Vdc 500mA or higher (maximum +16Vdc)

2. Kit features

2.1 i-Stamp microcontroller board

- Work abilities are compatible with BASIC Stamp 2SX module (BS2SX-IC)
- 50 MHz clock frequency . Operate up to 10,000 P-BASIC command/second
- 16KByte memory, separate 8 sections, 2KByte/each, erasable 100,000+ times
- 32 byte RAM with 64 byte Scratchpad RAM
- Consumption 65mA in full operation and 200mA in sleep mode
- Connecting to PC's serial port for programming and debugging
- 16 I/O, freedom separated work or set in groups from 4, 8 and 16 pins
- 30mA/30mA source/sink current. Maximum 60mA/60mA source/sink current per 8-pins groups (P0-P7/P8-P15)
- I/O pin can drive LED (with current limit resistor) and 6V servo motor directly
- LED power status
- Board sizes 1.7" x 1.2"
- Develop with BASIC Stamp Editor program

2.2 AX-2SX Activty board

- Support i-Stamp
- In-system programming and Debuggeing via serial port
- 8-LED display
- Relay driver with relay 12V
- Uni-polar Stepper motor driver share with LED on P0-P3 of i-Stamp
- Voice-coil 8W speaker
- LDR light sensor with RC circuit
- 4-Push button switch with resistor pull-up
- Serial interface connector (P15)
- Use with DC adapter 12V 500mA (not included)
- Polarity protection circuit

2.3 SLCD16x2 Serial LCD

- LCD 16 characters 2 lines
- Serial Input RS-232 or Invert/Non-invert TTL/CMOS logic level.
- 28 byte FIFO buffer, baudrate 2400 or 9600 bps selectable, 8 bit data, no parity, 1 stop bit.
- 1/8 or 1/16 Duty can be selected by jumper.
- Scott Edwards's LCD Serial Backpack ® command compatible addition with Extended Command that make LCD control easier.
- Easy to interface with microcontroller such as BASIC STAMP ® .
- Operation with 5 to 12 V.DC supply (5.1V. zener build-in)

3. Introduction to i-Stamp microcontroller

i-Stamp is the emulator of BS2SX-IC module which designed by Innovative Experiment Co.,Ltd., Thailand under co-operative with Parallax Inc., manufacturer BASIC Stamp from USA.

The size is similar to BS2SX-IC and can put on 24 pins socket. i-Stamp use BASIC Stamp interpreter licenced by Parallax Inc.. So make sure that i-Stamp ability is compatible.

Figure 2, shows i-Stamp schematic. It's similar to BS2SX-IC. The only one different is i-Stamp no Vin pin because inside i-Stamp has not +5V regulator circuit.

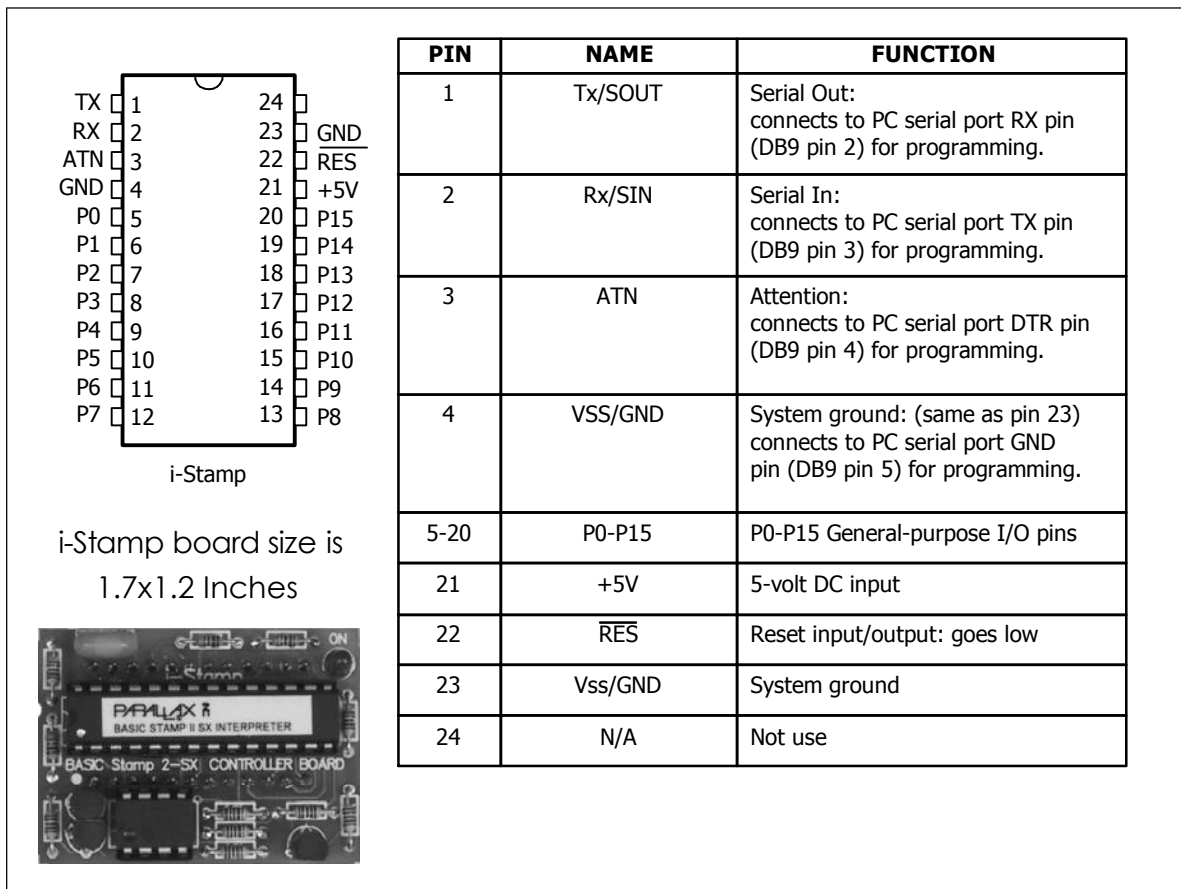


Figure 1-1 i-Stamp's Pin assignment and function

The heart of circuit is IC1 which SX-28AC microcontroller. Inside this micro controller contains P-BASIC 2SX interpreter firmwarer. The users have already written P-BASIC. The program is downloaded into i-Stamp via serial port. Signal is converted to TTL level by R2-R10 and Q1-Q3. Q1 sends data from IC1 to PC's serial port via pin2 (RxD). Q2 converter input level to send to IC1. Q3 use for receiving reset signal from computer to reset IC1. It means reset system together. However, the users can reset the system by external switch which connect to RESET pin.

Opearing program save to IC2 which is 16KByte serial EEPROM 24LC128. It means IC2 is the system memory program. If it's not correct, IC1 will notice to the users know the result.

IC1 receive clock signal from CR1 50MHz ceramic resonator. i-Stamp's port use IC1's pin 10-25. It calls P0-P15 instead for definding easier.

i-Stamp need +5V and at least 65mA supply from regulator. For reducing board as small as possible, it exclude power supply. The users just connect +5V and ground to i-Stamp and work on it.

4. Inside AX-2SX BASIC Stamp2SX Activity board

AX-2SX is the activity board that prepare many external components to interface with i-Stamp microcontroller for learning and experiment. You can interface all components very easy. With simple PBASIC programming can help you understanding about microcontroller interfacing concepts.

Figure 3 shows the physical of AX-2SX board and schematic shown in figure 4. SK1 is 24-pin female IDC socket is used for support i-Stamp. +5V regulated voltage supply is connected to pin 21 of i-Stamp. At pin 22 connect with RESET switch to reset the operation of i-Stamp. For interfacing with serial port, use pin 1 to 4 connect with pin 2, 3, 4 and 5 of DB-9 serial connector. These interface are use for downloading and debugging via Debug Terminal in BASIC Stamp editor software.

The detail of each interfacing circuit on AX-2SX board can describe as :

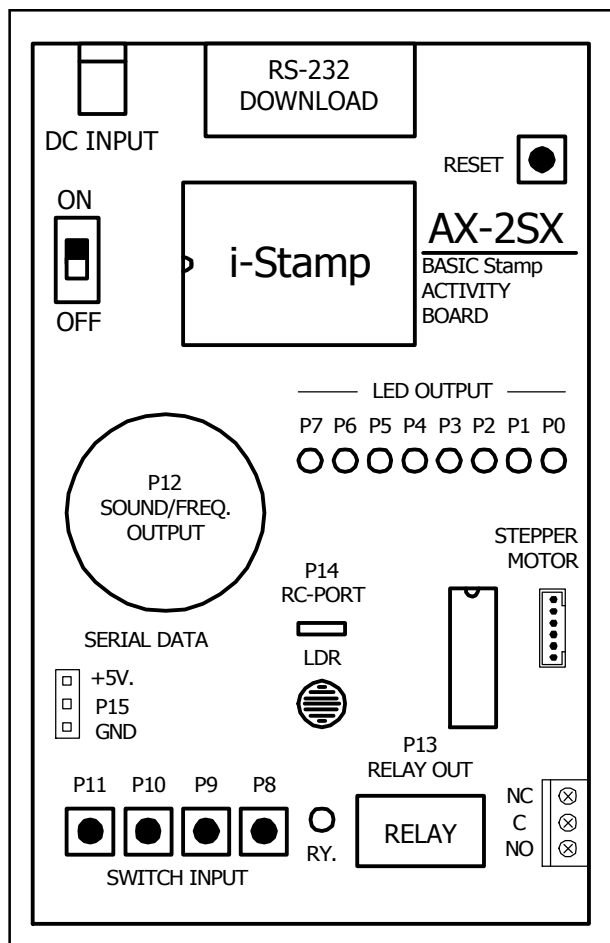


Figure 3 AX-2SX board overlay; each interface circuit with i-Stamp will detail. Such as 8-LED outputs label with P0 to P7 port pin of i-Stamp.

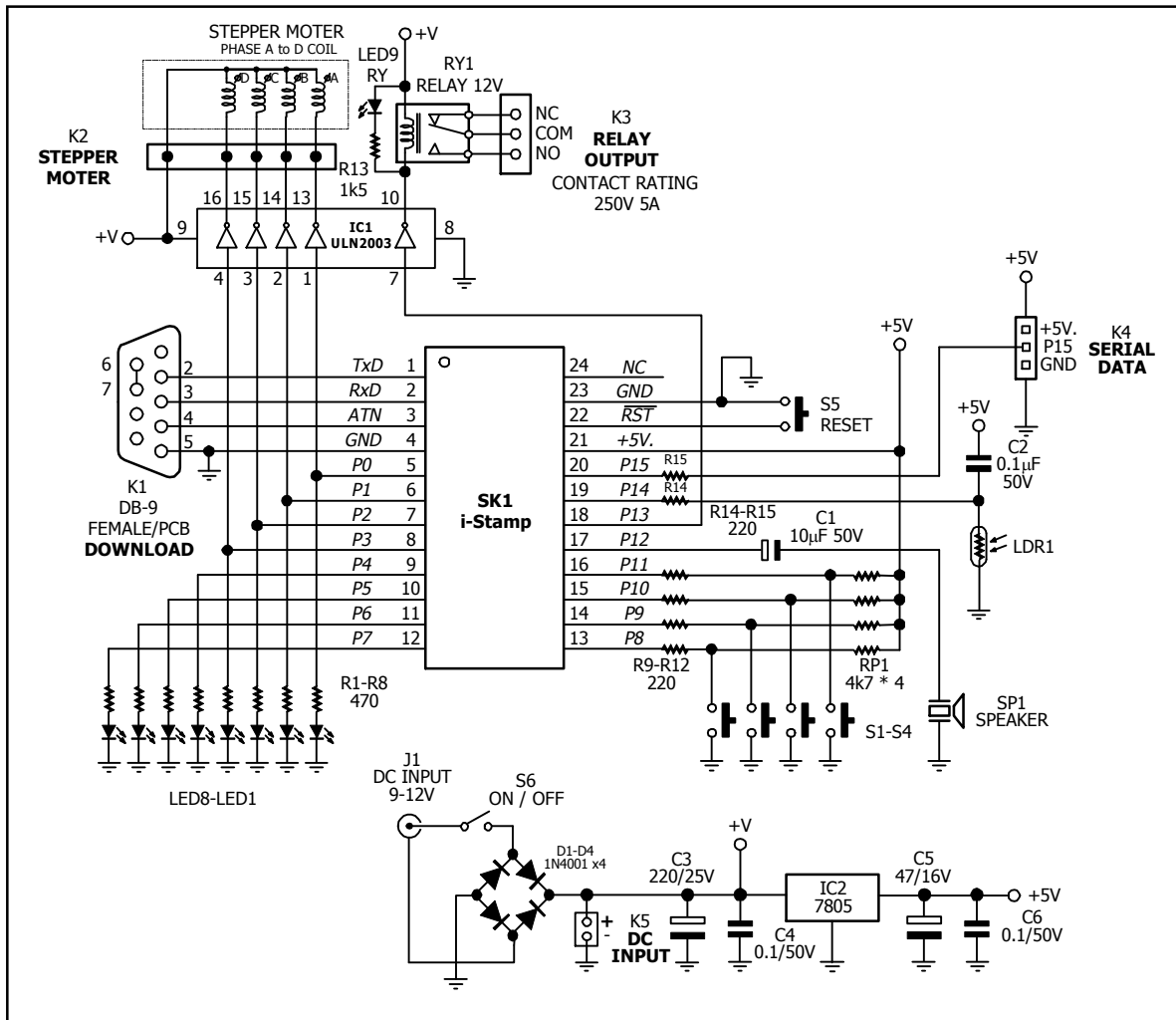


Figure 4 AX-2SX board schematic

4.1 8-LED outputs

All 8-LEDs will be connected with P0 to P7 of i-Stamp via current limit resistor. All LED will operate at Logic "1" or active high.

4.2 Stepper motor driver

At P0 to P3 of i-Stamp share with drive LED and connect with ULN2003 driver IC. ULN2003 will be use for driving a uni-polar stepper motor. ULN2003 contains 7 open-collector inverter. Its inpur can accept TTL logic and output can drive high current load over +5V. Maximum is +30V 500mA per output. In AX-2SX will connect with a uni-polar stepper motor. The motor supply voltage gets from DC adaptor.

Driving the stepper motor is not difficult. Sendd logic "1" from i-Stamp port (P0-P3) to input of ULN2003. After that ULN2003 will invert logic to "0". It cause the current draw into the motor's phase that connect with ULN2003 output. The shaft of motor will spin one step. If all phase are received the continuous signal, stepper motor spins continuous.

4.3 Sound driver

AX-2SX board provides a 100mW 8Ω speaker and connect with P12 of i-Stamp. i-Stamp can out the audio signal couple via C2; 10mF capacitor to drive this speaker. This circuit demonstrate the i-Stamp's performance about driving a small speake without external amplifier circuit

4.4 4-Input switches

At P8 to P11 are assigned to Input ports. They are connected 4 of push-button switches and connected 4 pull-up resistor to define logic "HIGH" in normal state. If any switch is pressed, that port will be connected to ground. Logic "0" will applied at that port. i-Stamp can read port's status with programming.

Addition at P8 to P11 has limit-current resistor 220Ω (R9 to R13) for protecting i-Stamp's port. Normally i-Stamp's port can connect to Ground directly but must set to INPUT only. The R9 to R13 are used to protect port destroy in case setting any port to output and switch is pressed. If not protected, i-Stamp's port will be destroy.

4.5 Relay driver

P13 of i-Stamp is connected with ULN2003 input (pin 7). Output of ULN2003 (pin 10) is connected with 12V relay. i-Stamp can active the relay operation with send logic "1" to pin 7 of ULN2003. ULN2003 will invert logic to activate relay. Relay's coil have current draw. LED9 lights up to indicates the operation and relay contact will switch from NC to NO. Relay contact rating is 220Vac 5A and suitable to drive 600W electric load. User can connect the electric appliance load to controlled by i-Stamp.

4.6 LDR circuit

One feature of i-Stamp is the simple analog signal processing with special command; RCTIME. This command concept is RC time constant operation. In AX-2SX board, use LDR (Light Dependent Resistor) and 0.1uF capacitor. They are connected to P14 of i-Stamp.

R14 resistor is connected with P14 in series for 2 purposes. One is assistance the RC operation start. Another function is current limitation from reverse current of capacitor rechaging.

4.7 Serial interface port

AX-2SX board assign P15 of i-Stamp to serial communication port to extension. The external device that connect at this port must have serial communication such as the Serial LCD, Serial keypad or Serial Real time clock module. Serial interface connector use 3-pins header. The assignment port from left is +5V, P15 or signal and Ground. Same any previous port, P15 has a current-limit resistor for protection.

The serial communication device that recommended for AX-2SX include SLCD16x2 Serial LCD (included this activity kit), ZX-44 Serial Keypad 4x4 and ZX-SERVO16 Servo controller board.

4.8 Power supply

AX-2SX board can get the voltage supply from 2 ways; from DC adaptor jack K2 and Terminal block K3. Diode D1 to D4 connect as bridge rectifier circuit for preparing the polarity of voltage supply. This circuit help AX-2SX board support all DC adpator's polarity. C3 capacitor is used for filtering the input supply voltage more smooth and C4 capacitor reduce the high frequency noise. Voltage at this point is called +V. It is used for Stpper motor drive and Relay driver circuit.

+V voltage will be regulated to +5V with IC2 7805. At 7805 output connect C5 capacitor for transient response operation.

5. Software tools

i-Stamp can work on AX-2SX board with BASIC Stamp editor software V2.2.6 or higher. Download free of charge at www.parallax.com.

User can see the software installation, how to use and PBASIC command reference from BASIC Stamp editor manual V2.0 or higher. Free download at www.parallax.com.



Activity 1 : Getting start with Akit-BASIC Stamp2SX

Purpose

Introduce to how to use i-Stamp microcontroller board with AX-2SX Activity board and how to interface with computer.

Part list

1. i-Stamp
2. AX-2SX Activity board
3. CX-232 Serial port cable
4. Personal computer that install BASIC Stamp Editor V2.2.6 or higher and a free serial port. If computer provides only USB port, require USB to RS-232 serial port converter. The UCON-232S is recommended.

Procedure

- 1.1 Put i-Stamp into 24-pin female header on AX-2SX Activity board. Must put the right direction following in figure A1-1.
- 1.2 Connect serial port cable between PC's serial port and AX-2SX board Following the figure A1-2. If use USB to Serial port converter, must connect the converter with USB port and connect the serial port cable between the converter and AX-2SX board instead.

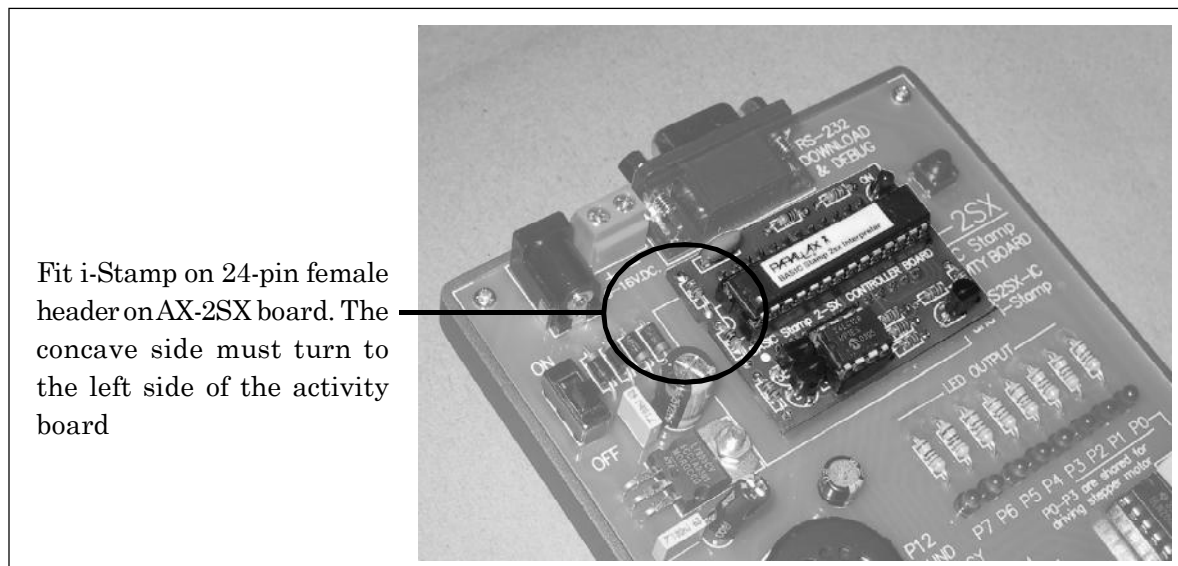


Figure A1-1 Show the fitting i-Stamp into AX-2SX Activity board

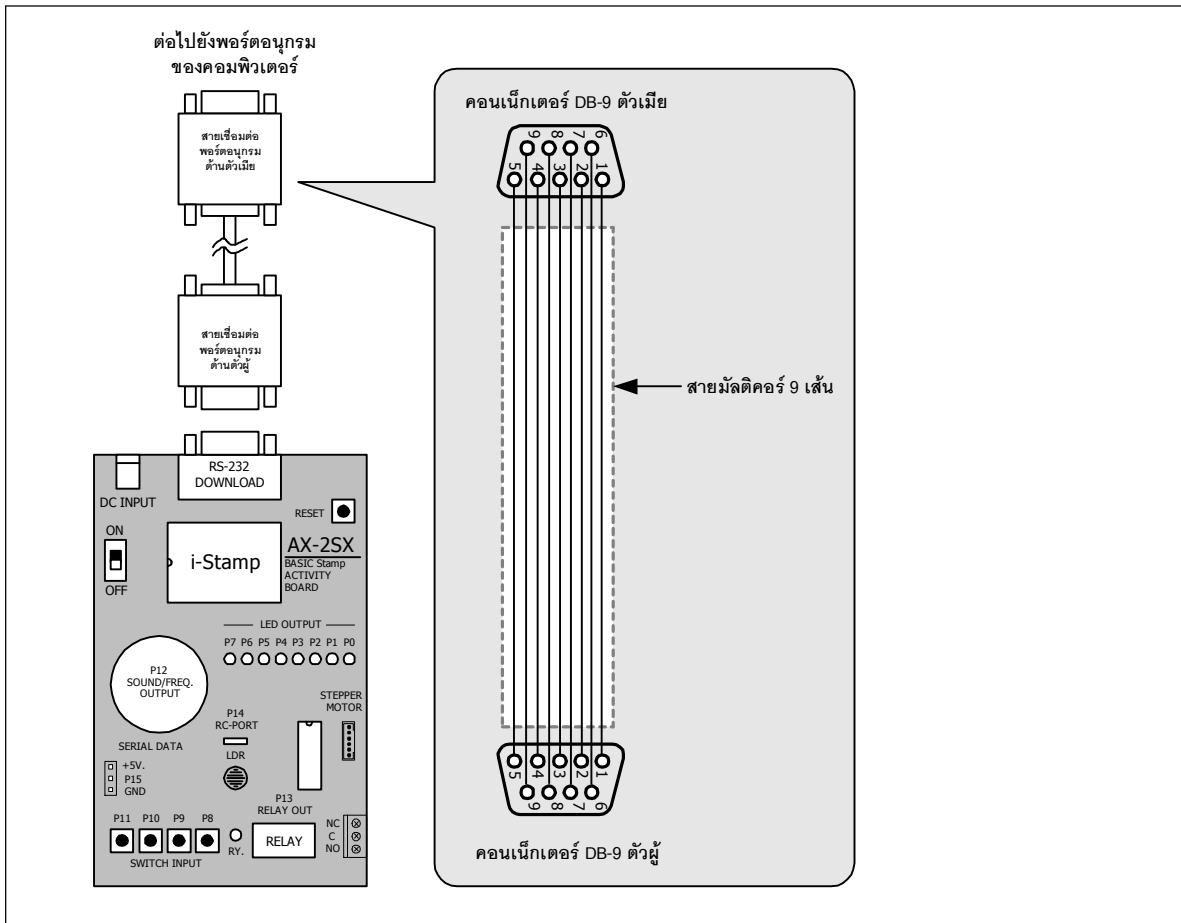


Figure A1-2 Interfacing of AX-2SX Activity board with computer's serial port

1.3 Plug DC adaptor for applying the supply voltage to AX-2SX Activity board. Open BASIC Stamp Editor software.

1.4 Check the communication between i-Stamp and BASIC Stamp Editor software by press Ctrl I key or click at Identify button or enter RUN menu then select Identify

If all correct, Identification box will appear and inform the version of PBASIC2SX chip following the figure A1-3. Observe COM1 box, it will show BASIC Stamp2SX V1.x (x is any number). Now i-Stamp can connect with BASIC Stamp Editor software.

1.5 Make the simple program to testing.

1.5.1 Select BASIC Stamp type by BASIC Stamp directive. Enter Directive menu and select Stamp → BS2SX following figure A1-4. The message **{ $\$$ STAMP BS2SX}** appears on first line. Press Enter key.

1.5.2 Still stay at Directive menu. Select serial port by Port → Com1 (or any Com port that connect) following figure A1-5. Messge **{ $\$$ SPORT COM1}** will appear at second line. Pess Enter.

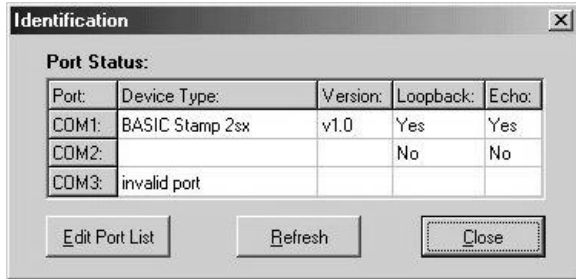


Figure A1-3 Display the identification of PBASIC2SX firmware on i-Stamp board. If connect complete at Device Type column must show name of BASIC Stamp and Version.

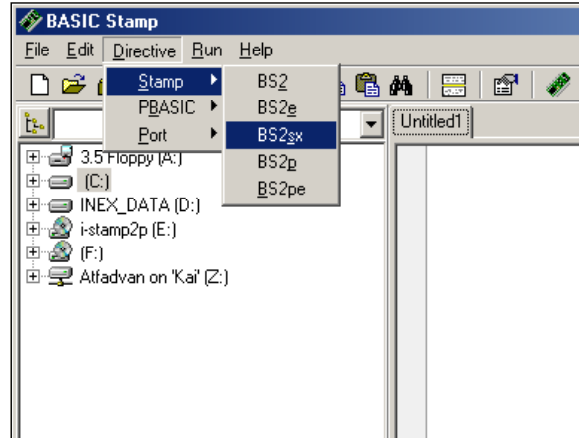


Figure A1-4 Selection BASIC Stamp directive. (select BS2SX)

1.5.3 At Directive menu, select version of PBASIC language by PBASIC à Version2.5 following figure A1-6. Message **{ $\$$ PBASIC 2.5}** appear at third line. Press Enter

1.5.4 At programming area, type **debug "welcome"**. This short code i-Stamp send message **welcome** to display on Debug Terminal of BASIC Stamp Editor software.Press Enter.

1.5.5 Click Run button. Debug Terminal will appears and show message "welcome" on the screen following figure A1-7

1.5.6 Press RESET switch on AX-2SX board. Program will show the same message at Terminal seen. Because RESET switch pressing means re-start the program running.

1.5.7 If dialogue box in figure A1-9 appears, it means **The communication between computer and i-Stamp fail. Check the serial port cable and free status of serial port.** In the figure A-10 show serial port cable connection diagram.

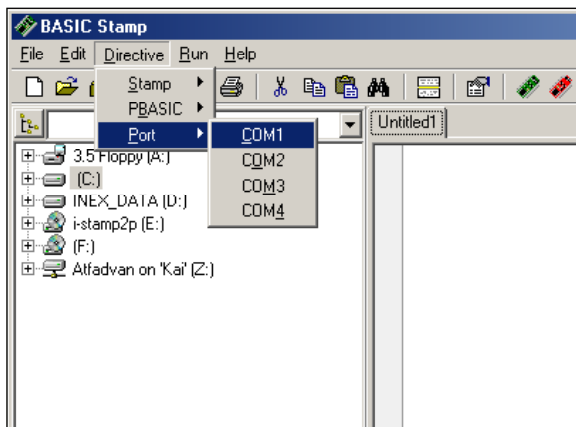


Figure A1-5 Shows "How to select and use Port directive" .

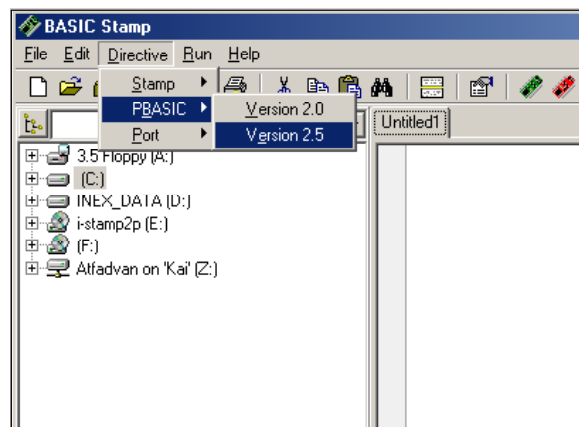


Figure A1-6 Shows "How to select PBASIC2.5 directive".

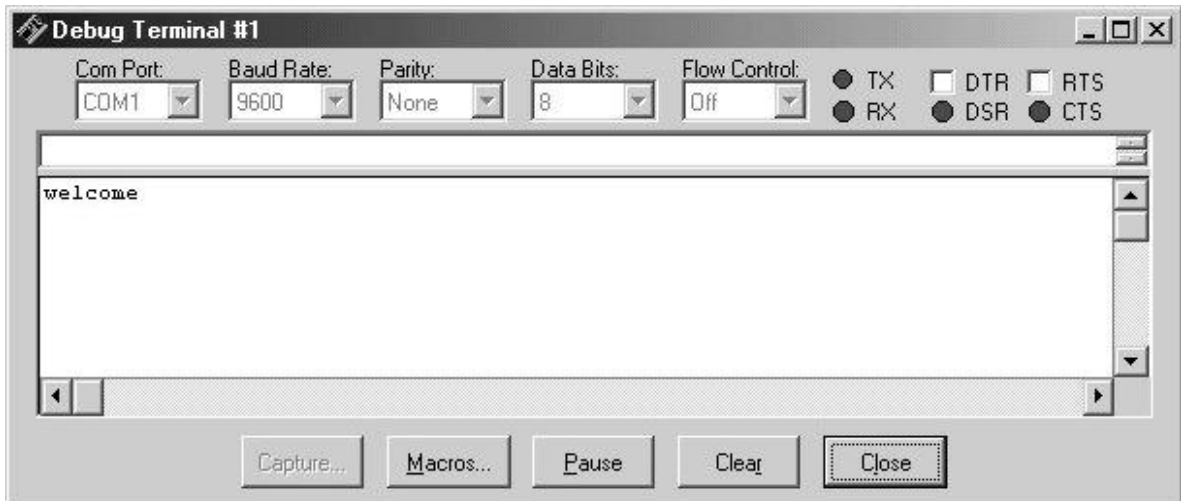


Figure A1-8 The Debug Terminal screen show the testing message welcome. It means i-Stamp can work ready. This terminal will appear everytime that use DEBUG command.



Figure A1-9 shows Error box on screen. It means software cannot detect i-Stamp. Must back to check serial port cable again and check FREE serial port

1.6 All experiment PBASIC code can store in .bsx filename.



