



# ezLCD-301

## Interface with Basic Stamp

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### 1. Introduction

The Basic Stamp is a micro controller based board used in variety of applications including robotics and education. Although, using character LCD has already been explained in Basic Stamp application notes, adding a color graphic display with touch screen capability brings a whole new world of excitement and applications to the Basic Stamp. The ezLCD-301 module is an affordable easy to use 400x240 pixel color graphic display that does not need complicated programming as typical graphic colors LCDs do. The ezLCD-301 uses a serial interface to communicate with the Basic Stamp; therefore, minimum wiring is required. Furthermore, the touch screen capability of the ezLCD can function as an input touch screen device or GUI. In this application note basic hardware and software requirements for interfacing the Basic Stamp with ezLCD-301 are presented and a simple application for turning on/off an LED on the Basic Stamp board using the ezLCD-301 touch screen will be implemented. Since the Basic Stamp can virtually establish serial communication with the ezLCD-301 through any of its available ports, this will potentially make it possible to use many ezLCD-301 units to be connected to one the Basic Stamp. This application note has been developed for the Basic Stamp 2 model but can easily be modified to work with other models of the Basic Stamp boards.

### 2. System Operation

The Basic Stamp 2, Stamps in Class, from the Parallax company is widely used among educators and hobbyists. This application note has been developed for the board that uses Basic Stamp 2 micro controller chip. There are different models of the Basic Stamp micro controller boards and software versions available from the Parallax company. For complete information of the boards and their software compatibility visit [www.parallax.com/sic](http://www.parallax.com/sic). The Board of Education (BOE) comes in two versions of Serial and USB connector that either one can be used in this application. Since the existing communication port (Serial/USB) is mostly used for program development and software upload, other pins have been used for ezLCD-301 interface. The BOE has 16 general purpose I/O pins that can be programmed for serial interface with the ezLCD-301 unit. The BOE board requires a 6-9V dc power supply and can provide 5V output at the Vdd pins on the board. The 5V can be used for the ezLCD-301 unit power, when USB connector is not connected. Alternatively, the ezLCD-301 can get power from the USB cable that can also be used for initializing the ezLCD-301 for serial interface. (**NOTE: NEVER USE USB AND EXTERNAL 5V FOR ezLCD-301 AT THE SAME TIME**). Only three pins as TX, RX and GND are required for the interface. The pin that transmits data is called TX and the one that receives data from the ezLCD is called RX. Do not forget that RX and TX of the ezLCD-301 are cross connected to the BOE, RX and TX pins. In this application pin 15 of the BOE is used as TX and pin 14 as RX. The pin assignment is changeable through the software. After the Basic Stamp and the ezLCD-301 are programmed the USB cables are not required anymore and the ezLCD unit can get power from the BOE board for stand alone operation.

### 3. Basic Stamp and ezLCD setup

In this section the required steps for programming are described. Follow the instruction for easy setup of the units:

- 3.1 After supplying power to the BOE, connect the BOE board to the computer using a USB cable. If the BOE has serial interface, use a USB to RS232 converter board from the parallax company. Other brand USB to RS232 converters might not be compatible. At this point set the power switch selector to position 1, that will power up the Basic Stamp board.

3.2 Run the Basic Stamp Windows Editor software on your PC. The software is free and can be downloaded from the [www.parallax.com](http://www.parallax.com) website. In the program under Run menu, click Identify or just press F6 key on your keyboard. If the connection is correct the software should identify the Basic Stamp device and its version as shown in figure 1. In case the device is not identified check your power supply or follow instructions on trouble shooting the connection on the Parallax company website.

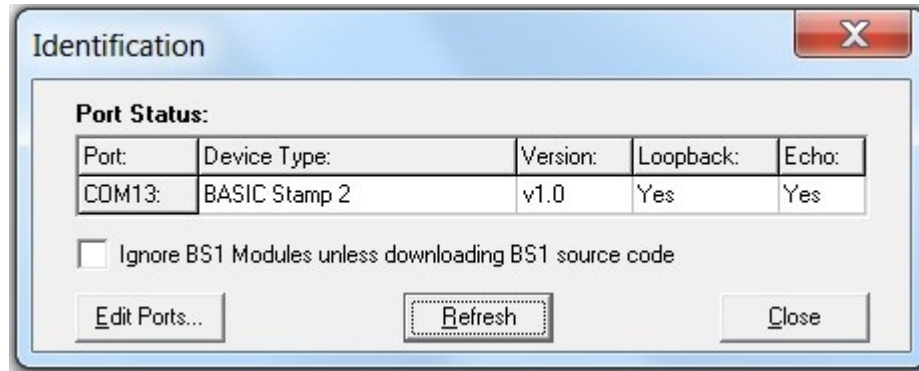


Figure 1. Basic Stamp identification by the editor software

3.3 At this time the Basic Stamp board is ready for programming. You can type in the listed code in Appendix. 1 or alternatively, you can download the program ezLCDBasicStamp.BS2 from the [www.earthLCD.com](http://www.earthLCD.com) website. Make sure the two lines containing “ {\$STAMP BS2}” and “ {\$PBASIC 2.5}” are typed correctly. These two lines are language directives that are important for identifying the hardware device and the software version. See Basic Stamp Quick reference for more information. Program the Basic Stamp board using the downloaded program. This can be done using Run menu and click Run, or the Run icon on the menu bar or F9. The program will be uploaded to the Basic Stamp and debug menu will pop up. At this step the BOE is ready for the ezLCD-301 interface.

3.4 Connect the ezLCD-301 unit to the computer USB port. The ezLCD default communication port is the USB device. In order to change it to serial communication you need to add the following line to the “startup.ezm” file in the ezLCD “USER\MACROS\” directory.

```
CMD serial2 9600 1 N81
```

This command will set the ezLCD serial port to 9600 baud rate with 8 data character, No parity and 1 stop bit. Do not forget to comment out the following command line:

```
CMD CDC
```

The “CMD CDC” will set the ezLCD in USB command mode for debugging and software development. Do not forget that the ezLCD should be in Verbose off mode too. In this case detailed description of commands will not be sent out on ezLCD serial port. For this purpose, add the following command to your startup.ezm file:

```
VERBOSE OFF
```

Save the “startup.ezm” file and restart the ezLCD by simply unplugging and plugging it back to the USB port.

3.5 Disconnect power from the BOE or set the power switch on BOE to position 0. Disconnect the ezLCD-301 unit from USB port and connect the RX, TX, Vdd and GND of the BOE board to ezLCD corresponding pins. Make sure to use correct connector pin for 5V supply of the ezLCD, since it can accept 3V input too. The required connections are shown in figure 2. Make sure neither of the units have power when doing the connections. After everything is wired up, connect the supply voltage.

3.6 Power up the BOE by setting the power switch selector to position 1. The green LED should light up and the ezLCD will be initialized and will show two buttons ON and OFF on the display. Using the touch screen of the ezLCD unit you can turn ON/OFF the pin 0 of the BOE board. This pin can be connected to an LED via a resistor for visual indication as shown in figure 2.

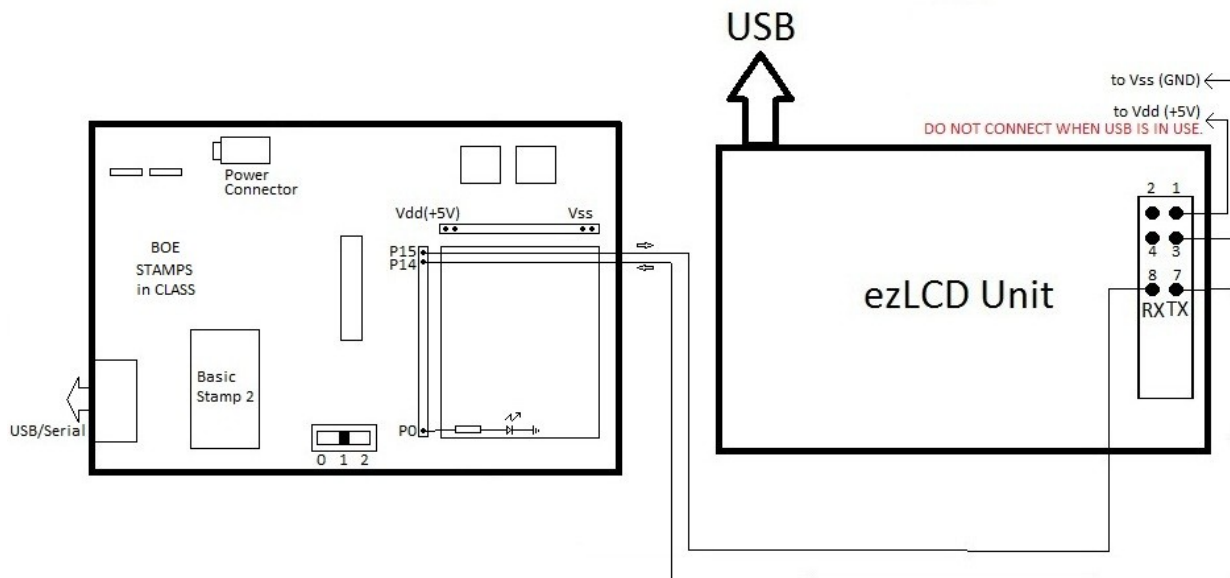


Figure 2 . Basic Stamp and the ezLCD-301 wiring connections

#### 4. Basic Stamp software code

The Basic Stamp program is used to initialize the ezLCD display and define active buttons (widgets) on the screen. The first part of the program defines pins for serial input (pin 14) and serial output (pin 15). The next section defines baud rate for different types of Basic Stamp models. In this application Basic Stamp 2 and 9600 baud rate have been used. The initialization of the ezLCD-301 is performed using the SEROUT command. Different types of themes and colors are defined and two green and red buttons are initialized on the display. When ON or OFF buttons are pressed, 5 bytes of data is sent back to the Basic Stamp using the established serial port. BP1 means that button 1 has been pressed. The same format exists for button 2. Carriage return and line feed are also included in the data packet received. The SERIN() command is used to receive the bytes sent from the ezLCD-301 unit. After this, the software compares it with the BP1 and BP2 strings and sets the pin 0 ON and OFF using HIGH or LOW commands respectively. A DEBUG command has been used to monitor the received data from the ezLCD-301 unit on the computer screen. If the PC is not used you can comment this line out. A complete source code of the Basic Stamp with comment are listed in Appendix 1.

#### 5. Conclusion

A basic application using ezLCD-301 graphic touch screen LCD with the Basic Stamp board has been developed. The Basic Stamp uses serial communication for interfacing with the ezLCD-301, therefore, only two wires are required for the interface. The ezLCD-301 can virtually connect through any available pins of the Basic Stamp unit, provided it is defined in the software code. Multiple ezLCD units can be used with one BOE board. The ezLCD unit can be used as a user interface that has a graphic color display combined with touch screen buttons widgets developed in ezLCD. Even though this is a very simple application, but it can be used as a starting point for developing more complex and various applications. The output of the LED can easily be connected to an Opto TRIAC to turn on the room lamp or an electric fan.

## 6. Material List

A list of materials used in this application note is provided in Table 1. All components can be purchased from the listed supplier. A complete list of suppliers are listed in Appendix 2.

Table 1. List of material

	Material	Qty	MFR	MFR PIN	Digi-Key PIN
1	EzLCD-301	1	EarthLCD Company		
2	Basic Stamp Unit	1	Parallax Company		

## Revision History

10/11/2011- Revision 0- Initial version

## Appendix 1. Source Code

A complete list of codes with comments are provided in this section. The program can also be downloaded from the [www.earthLCD.com](http://www.earthLCD.com) website.

```
' ezLCDBasicStamp.bs2
' This is a simple program to show the interface of ezLCD-301 unit
' with Basic Stamp board. Even though the code has been written for BS2
' board it can easily be modified for BS1 and other Basic Stamp models.
' This simple program defines two Widget buttons on the ezLCD-301 unit
' That can turn an LED connected to PIN 0 On/Off.
' Any pin of the Basic Stamp board can be defined for the serial communication
' with ezLCD-301. It just need to be defined at the beginning of the program.
' For longer processing routines consider delays and make sure to read
' the application notes of the Basic Stamp about the processing speed in
' order not lose any sent data from the ezLCD unit.
' {$STAMP BS2}
' {$PBASIC 2.5}
SO PIN 15 ' serial output pin TX
SI PIN 14 ' serial input pin RX
#SELECT $STAMP ' defines the Baud rate for different Basic Stamps ICs
#CASE BS2, BS2E, BS2PE
T1200 CON 813
T2400 CON 396
T9600 CON 84
T19K2 CON 32
T38K4 CON 6
#CASE BS2SX, BS2P
T1200 CON 2063
T2400 CON 1021
T9600 CON 240
T19K2 CON 110
T38K4 CON 45
#CASE BS2PX
T1200 CON 3313
T2400 CON 1646
T9600 CON 396
T19K2 CON 188
T38K4 CON 84
#ENDSELECT
Inverted CON $4000
```

```

Open CON $8000
Baud CON T9600 '9600 Baud rate selected for interface with ezLCD
serStr VAR Byte(5) ' define an string for storing the received data from ezLCD
Main:
SEROUT SO, Baud, ["cls black", CR, LF] ' Clear display to black color
PAUSE 10 ' wait 10ms
SEROUT SO, Baud, ["theme 1 9 3 0 0 0 8 8 8 8", CR, LF] 'defines Theme 1 for 'button 1
PAUSE 10
SEROUT SO, Baud, ["theme 2 5 20 3 3 3 4 4 4 4", CR, LF] 'defines Theme 1 for 'button 2
PAUSE 10
SEROUT SO, Baud, ["fontw 1 sans72", CR, LF] 'defines font for button 1 widget
PAUSE 10
SEROUT SO, Baud, ["fontw 2 sans72", CR, LF] 'defines font for button 2 widget
PAUSE 10
SEROUT SO, Baud, ["string 1 ON", CR, LF] ' defines string for button 1
PAUSE 10
SEROUT SO, Baud, ["string 2 OFF", CR, LF] ' defines string for button 2
PAUSE 10
SEROUT SO, Baud, ["button 1 10 40 185 140 1 0 25 1 1", CR, LF] 'defines button '1
PAUSE 10
SEROUT SO, Baud, ["button 2 205 40 185 140 1 0 25 2 2", CR, LF] 'defines button '2
PAUSE 3000 ' waits for ezLCD finish sending feedback
' about its displays
DO ' DO LOOP starts here
SERIN SI, Baud, [STR serStr\5] ' Receives 5 bytes from the ezLCD if any button 'pressed
' including CR and LF
DEBUG STR serStr ' display received data on the debugger console
' Can be commented if PC is not used
IF serStr(0) = "B" THEN IF serStr(1) = "P" THEN ' Compares if the received 'data is BP1
IF serStr(2) = "1" THEN HIGH 0 ' which means button 1 pressed then
ENDIF ' set pin 0 HIGH
IF serStr(0) = "B" THEN IF serStr(1) = "P" THEN ' Compares if the received 'data is BP2
IF serStr(2) = "2" THEN LOW 0 ' which means button 2 pressed then
ENDIF ' set pin 0 LOW
LOOP ' repeat for ever
END ' main end

```

## Appendix 2. List of Suppliers

EarthLCD Company  
3184-J Airway Ave,  
Costa Mesa, CA 92626  
Phone:949-248-2333  
Fax:949-248-2392