



Bluetooth Evaluation Board™

Evaluation board for Toothpick, LinkMatik, Bluemantik and Toothpick Stamp Edition

Summary

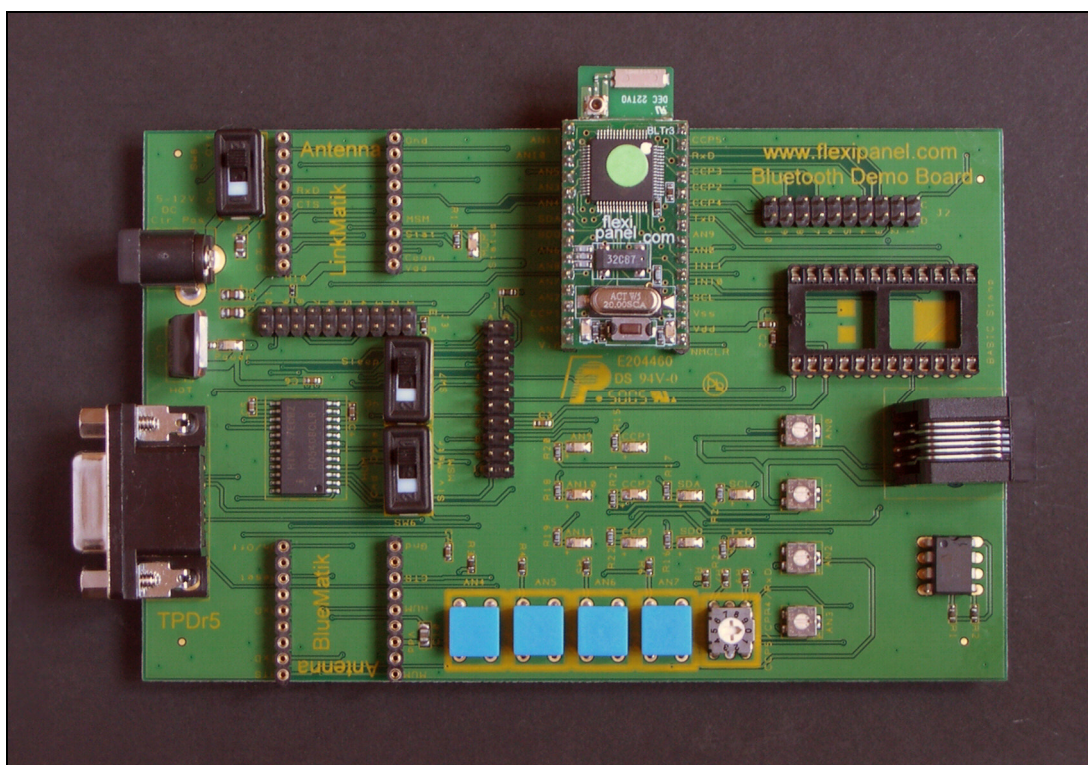
The Bluetooth Evaluation Board is designed to evaluate FlexiPanel Ltd's Bluetooth products:

- Toothpick
- LinkMatik
- BlueMatik
- Toothpick Stamp Edition

These are not supplied with the evaluation board but must be bought separately.

Features

- Sockets for all modules
- Power regulator, switch and LED, powered from 5-12V DC
- Jumper switches for board configuration
- RS232 serial port and TTL to RS232 converter
- Toothpick ICD2 programming socket
- 24C256 I2C memory chip
- All the pushbuttons, LEDs, presets and switches to run the tutorials in the products data sheets.



Ordering Information

Manufactured to ISO9001:2000



Part No	Description
BTEVAL	Bluetooth Evaluation Board

Evaluation Board Overview

Intended uses

The primary aim of the Bluetooth Evaluation Board is to allow evaluation of FlexiPanel Ltd's Bluetooth products as easily as possible. It is designed to allow the developer to follow the tutorials and examples in the product data sheets.

Additionally, the evaluation board can be used during development as a reliable, tested environment while troubleshooting.

Power Supply

The evaluation board may be powered by a reasonable smooth unregulated 5V – 12V DC power source via the 2.5mm center-positive connector. No heat sink is provided for the voltage regulator, so expect it to get quite warm.

Switches, LEDs and Presets

The following peripheral components are permanently connected:

- LEDs to Toothpick pins AN9, AN10, AN11, CCP1 and SDO.
- Presets that can vary the voltage of Toothpick pins AN0, AN1, AN2 and AN3 smoothly between 0V and 5V.
- Pushbuttons to control the voltages of Toothpick pins AN4, AN5, AN6 and AN7. 5V when pressed and 0V otherwise.
- Bit 2 of the binary encoding rotary switch to CCP5.
- Bit 3 of the binary encoding rotary switch is unconnected.
- Power LED.
- LED connected to the *Status* pin of the LinkMatik and the *MUM* pin of the BlueMatik.

The following peripheral components are conditionally connected according to the configuration pins as detailed in the *General Setup* sections:

- LEDs to Toothpick pins CCP2, CCP3, SDA, SCL, TxD
- Bit 1 of a binary encoding rotary switch to CCP4.
- Bit 0 of a binary encoding rotary switch to RxD.

I2C memory

The 24C256 I2C serial memory is conditionally connected, according to the configuration pins, to pins SDA and SCL of the Toothpick.

Pull-up resistors are included. The address pins are all held low, so the Toothpick *mStr* value to access the memory is 0x10.

ICD2 programming connector

The RJ11 programming connector allows you to program a ToothPIC directly using Microchip MPLAB ICD2.

Since the NMCLR, INT0 and INT1 lines must be isolated, no BASIC Stamp should be installed at the same time as an ICD2 is connected.

Jumper connections

Jumper connections allow the evaluation board to be dynamically reconfigured as detailed in the *General Setup* sections.

A key is printed next to each jumper connection strip. The pin columns are denoted by letters, the rows by numbers. Note that the links might need to be inserted in either the horizontal or vertical positions.

Switches

SW7 switches the LinkMatik *Connect / Sleep* pin between the *Sleep* state and the *On* state.

SW6 may be used to switch the LinkMatik *Master / Slave Mode* pin between *Master* and *Slave* modes, and to switch the BlueMatik *HUM* pin between *Command* and *Data* modes. Note that whether this switch has any effect depends on the jumper settings, since these modes can alternately be driven by the state of the RS232 DTR line.

RS232 driver and Serial Port

The serial port may be used by any of Toothpick, LinkMatik, BlueMatik or the BASIC Stamp according to configuration.

Module Sockets

Only insert one of BlueMatik, LinkMatik and Toothpick at a time. Only insert a BASIC Stamp when used with Toothpick Stamp Edition.

Toothpick

General Setup

Insert the Toothpick in the evaluation board so that the antenna overhangs the edge of the board. There should be nothing inserted in the LinkMatik, Stamp and BlueMatik sockets. Remove any existing links and then insert links over the following configuration pins:

C5 - C6	(CCP4 to rotary switch)*
C7 - D7	(CCP3 to its LED)
C10- D10	(CCP2 to its LED)
E6 - F6	(TxD to its LED)

*Note: on one version of the board (TPDr5), the "C5 - C6" is incorrectly labeled on the rear as "C6 - D6"

If the RS232 port is to be used (e.g. DARC-I tutorial) insert links over the following configuration pins:

A3 - A4	(RS232 TxD to RxD pin)
B5 - B6	(RS232 RxD to TxD pin)
C4 - D4	(RS232 TxD to RxD pin)

In addition, if flow control is to be used (e.g. DARC-I tutorial) insert links over the following configuration pins. The ICD2 programming socket cannot be used with these pins in place:

A8 - A9	(RS232 CTS to INT0 pin)
A10- B10	(RS232 CTS to INT0 pin)
B2 - B3	(RS232 RTS to INT1 pin)
B8 - B9	(RS232 RTS to INT1 pin)

If the RS232 port is *not* to be used (e.g. DARC-II tutorial) insert a link over the following configuration pin:

D4 - D5	(RxD to rotary switch)
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If the I2C memory is to be used insert links over the following configuration pins:

C3 - D3	(SDA to I2C memory)
D1 - D2	(SCL to I2C memory)

If the I2C memory is *not* to be used insert links over the following configuration pins:

C1 - D1	(SCL to its LED)
C3 - C2	(SDA to its LED)

Toothpick Slave Tutorial

To follow the Toothpick Slave tutorial provided in the Toothpick data sheet, remove any existing links and then connect the links for RS232 (no flow control) and I2C as follows:

A3 - A4	(RS232 TxD to RxD pin)
B5 - B6	(RS232 RxD to TxD pin)
C3 - D3	(SDA to I2C memory)
C4 - D4	(RS232 TxD to RxD pin)
C5 - C6	(CCP4 to rotary switch)
C7 - D7	(CCP3 to its LED)
C10- D10	(CCP2 to its LED)
D1 - D2	(SCL to I2C memory)
E6 - F6	(TxD to its LED)

Step 6 of the tutorial, adding an RS232 level shifting circuit, is now complete and you may simply connect your PC serial port to the DB9 socket on the evaluation board. The TxD LED will glow more or less continually during the tutorial because the TxD is usually in the high state.

You may follow the tutorial exactly as in the data sheet. When you have completed the tutorial you might like to experiment with the I2C memory as follows:

Type the command:

```
04010C01
```

to activate the I2C memory. This command a non-volatile setting which only takes effect after a device reset, so type the command

```
0200
```

to reset the Toothpick and wait for the greeting message.

To store the values 0x05, 0x06, 0x07, 0x08 at location 0x0100, type the command

```
090F10000105060708
```

To retrieve those same values, type the command

```
060E10000104
```

The retrieved values will be the last 8 characters of the response.

DARC-I Tutorial

To follow the DARC-I tutorial provided in the DARC-I data sheet, remove any existing links and then connect the links for no RS232 and no I2C as follows:

C1 - D1	(SCL to its LED)
C3 - C2	(SDA to its LED)
C5 - C6	(CCP4 to rotary switch)
C7 - D7	(CCP3 to its LED)
C10- D10	(CCP2 to its LED)
D4 - D5	(RxD to rotary switch)
E6 - F6	(TxD to its LED)

You may follow the tutorial exactly as in the data sheet. Remember that presets are connected to AN0 and AN1, allowing you to set the voltages on these pins easily.

DARC-II Tutorial

To follow the DARC-II tutorial provided in the DARC-II data sheet, remove any existing links and then connect the links for no RS232 and no I2C as follows:

C1 - D1	(SCL to its LED)
C3 - C2	(SDA to its LED)
C5 - C6	(CCP4 to rotary switch)
C7 - D7	(CCP3 to its LED)
C10- D10	(CCP2 to its LED)
D4 - D5	(RxD to rotary switch)
E6 - F6	(TxD to its LED)

You may follow the tutorial exactly as in the data sheet. Remember that presets are connected to AN0 to AN2, allowing you to set the voltages on these pins easily. The parallel input comprised of CCP5/CCP4/RxD is connected to the rotary switch.

LinkMatik

General Setup

Insert the LinkMatik in the evaluation board so that the antenna overhangs the edge of the board. There should be nothing inserted in the Toothpick, Stamp and BlueMatik sockets. Remove any existing links and then insert links over the following configuration pins:

A3 - A4	(RS232 TxD to RxD pin)
A8 - A9	(RS232 CTS to RTS pin)*
A10- B10	(RS232 CTS to RTS pin)*
B2 - B3	(RS232 RTS to CTS pin)
B5 - B6	(RS232 RxD to TxD pin)
B8 - B9	(RS232 RTS to CTS pin)

*Note: on one version of the board (TPDr5), the "A8 - A9" and "B8 - B9" is omitted on the rear-side labels.

You can decide whether the MSM input is controlled by switch SW6 or via the DTR line on the RS232 port. To control it from the switch SW6, insert a link over the following configuration pin:

E7 - E8	(SW6 to MSM input)
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To control the HUM input from DTR line, insert links over the following configuration pins:

A6 - A7	(DTR to MSM input)
E7 - F7	(DTR to MSM input)

To operate in normal transceiver mode, insert links over the following configuration pins:

E4 - E5	(RS232 RxD to TxD pin)
E9 - F9	(RS232 TxD to RxD pin)

To operate in configuration mode, insert links over the following configuration pins:

E4 - F4	(4k7 pull-down to TxD pin)
F8 - F9	(4k7 pull-down to RxD pin)

Slave Mode

To evaluate LinkMatik in slave mode, put the SW7 switch in the Sleep position, remove any existing links and then connect the links as follows:

A3 - A4	(RS232 TxD to RxD pin)
A8 - A9	(RS232 CTS to RTS pin)
A10- B10	(RS232 CTS to RTS pin)
B2 - B3	(RS232 RTS to CTS pin)
B5 - B6	(RS232 RxD to TxD pin)
B8 - B9	(RS232 RTS to CTS pin)
E7 - E8	(SW6 to MSM input)
E4 - E5	(RS232 TxD to RxD pin)
E9 - F9	(RS232 RxD to TxD pin)

LinkMatik is now configured so that the MSM input is controlled by SW6 and the Connect / Sleep line is controlled by SW7.

Apply power and put SW6 into the *Slv* position. Then put SW7 into the *On* position. The Status LED should flash to indicate that it has entered Slave mode and is waiting for a device to connect to it.

To see the LinkMatik working, two HyperTerminal sessions must be started on a PC. One will be connected via the RS232 port, the other via Bluetooth. What you type into one console will appear in the other.

First connect the DB9 socket to your PC's serial port. Start a HyperTerminal session at 9600 baud, hardware flow control, 8 bits no parity, one stop bit.

Second, use the Bluetooth Manager on your PC to discover LinkMatik. You will need to pair with it, since security is enabled. The PIN code is four zeroes '0000'. Connect to LinkMatik and observe that the Status LED glows steadily as the connection is complete.

Start another HyperTerminal session, using the COM port number assigned by the Bluetooth Manager when you made the connection. The baud settings are ignored, so enter anything you like for them.

You should now find that anything you type in one HyperTerminal window appears in the other HyperTerminal window.

Configuration Mode

Important: If you have previously run the Slave Mode evaluation, be sure to close the HyperTerminal windows as they will otherwise 'hog' the COM ports and prevent correct Bluetooth communication.

To evaluate LinkMatik in configuration mode, put the SW7 switch in the Sleep position, remove any existing links and then connect the links as follows:

A3 - A4	(RS232 TxD to RxD pin)
A8 - A9	(RS232 CTS to RTS pin)
A10- B10	(RS232 CTS to RTS pin)
B2 - B3	(RS232 RTS to CTS pin)
B5 - B6	(RS232 RxD to TxD pin)
B8 - B9	(RS232 RTS to CTS pin)
E7 - E8	(SW6 to HUM input)
E4 - F4	(4k7 pull-down to TxD pin)
F8 - F9	(4k7 pull-down to RxD pin)

Apply power and put SW7 into the *On* position. The Status LED should flash rapidly, indicating that it is in configuration mode.

Use the Bluetooth Manager on your PC to discover LinkMatik and connect to it. If your computer requires it, use the PIN code of four zeroes 0000. Also in the Bluetooth Manager, make a note of your PC's Bluetooth device name.

Start the LinkMatik configuration tool and enter the first few characters of the PC's Bluetooth device name as the *Pair Match Prefix*. For example, the PC used to write this documentation has the name *FlexiPanel Vaio Laptop*, so *FlexiPanel* was entered as the *Pair Match Prefix*. This is being done so that in the next section, where master mode is evaluated, LinkMatik will search for and connect to the PC.

Press the Program LinkMatik Now button to write the new settings to LinkMatik. The LED will extinguish for one second and then glow steadily indicating configuration is complete. The first time you power up after programming,

Master Mode

To evaluate LinkMatik in master mode, first complete the configuration mode evaluation since this configures LinkMatik to connect to your PC. Then with the SW7 switch in the Sleep position, remove any existing links and then connect the links as for the slave mode evaluation:

A3 - A4	(RS232 TxD to RxD pin)
A8 - A9	(RS232 CTS to RTS pin)
A10- B10	(RS232 CTS to RTS pin)
B2 - B3	(RS232 RTS to CTS pin)
B8 - B9	(RS232 RTS to CTS pin)
B5 - B6	(RS232 RxD to TxD pin)
E7 - E8	(SW6 to MSM input)
E4 - E5	(RS232 TxD to RxD pin)
E9 - F9	(RS232 RxD to TxD pin)

LinkMatik is now configured so that the MSM input is controlled by SW6 and the Connect / Sleep line is controlled by SW7.

Apply power and put SW6 into the *Mstr* position. Then put SW7 into the *On* position. The Status LED should flash to indicate that it has entered Master mode and is looking to connect to your PC.

After a few seconds it should discover your PC and it will automatically connect to it. Depending on whether previous pairings have been remembered or not, it may be necessary to enter the PIN code 0000 on the PC again.

If you wish to verify that the connection is working, start two HyperTerminal sessions on the PC as you did for the Slave Mode evaluation. What you type into one console will appear in the other.

BlueMatik

General Setup

Insert the BlueMatik in the evaluation board so that the antenna overhangs the edge of the board. There should be nothing inserted in the Toothpick, Stamp and LinkMatik sockets. Remove any existing links and then insert links over the following configuration pins:

A3 - A4	(RS232 TxD to RxD pin)
A8 - A9	(RS232 CTS to RTS pin)
A10- B10	(RS232 CTS to RTS pin)
B2 - B3	(RS232 RTS to CTS pin)
B5 - B6	(RS232 RxD to TxD pin)
B8 - B9	(RS232 RTS to CTS pin)
E4 - E5	(RS232 TxD to RxD pin)
E6 - F6	(TxD to TxD LED)
E9 - F9	(RS232 RxD to TxD pin)

You can decide whether the HUM input is controlled by switch SW6 or via the DTR line on the RS232 port. To control it from the switch SW6, insert a link over the following configuration pin:

E7 - E8	(SW6 to HUM input)
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To control the HUM input from DTR line, insert links over the following configuration pins:

A6 - A7	(DTR to HUM input)
E7 - F7	(DTR to HUM input)

Evaluation Setup

LinkMatik should be configured so that the HUM input is controlled by SW6 and MUM output lights the Status / MUM LED. Ensure SW6 is in the *Cmd* position.

First connect the DB9 socket to your PC's serial port. Start a HyperTerminal session at 115200 baud, hardware flow control, 8 bits no parity, one stop bit. In *File > Properties > Settings > ASCII Setup*, ensure the following are checked:

Echo characters typed locally
Append line feeds to incoming line ends

Also ensure the following is not checked

Send line ends with line feeds

Example AT commands

The following examples are not exhaustive. Refer to the product documentation for a full list of the commands.

Apply power and the following greetings message similar to the following will appear:

```
+BINF:830,2,C7,1D4140,Anonymous  
READY
```

If you wait 10 seconds before typing anything, the following message will also appear:

```
+BURT:1D8,0,0
```

This simply indicates that the baud rate has reverted to 115200 baud (which it was anyway), since no input has been received in the first 10 seconds.

Note how the MUM LED extinguishes while the response is being send. This is how you can differentiate between a response from BlueMatik and data from the Bluetooth connection.

To discover Bluetooth devices in range, type the following command:

```
+BURT:1D8,0,0
```

This starts a 10 second scan for devices. Each device found will result in a message similar to the following:

```
+BINQ:12,37,30D180,320110, PocketPC
```

The following message indicates that the scan is complete:

```
+BINC:1
```

To BlueMatik into encrypted slave mode so that other devices can connect to it securely, type the following commands:

```
AT+BRSR=1,0 (replies OK, then +BRSR)
```

```
AT+BWLP=7 (replies OK)
```

```
AT+BSEC=2 (replies OK)
```

```
AT+BSLV (replies OK)
```

Then use the Bluetooth Manager on your PC to discover BlueMatik. When you have discovered it, select in the Bluetooth Manager to pair with it, using the PIN code 0000 (four zeroes). A message similar to the following will appear:

```
+BLNK:800,46,B939B0
```

To indicate that you have no link key yet, you should respond by typing:

```
AT+BLNK=
```

You will then receive the message:

```
+BPIN:800,46,B939B0
```

You can then pair with the PIN code by typing:

```
AT+BPIN=0000
```

When pairing is complete, you will receive a message similar to the following:

```
+BPRC:800,46,B939B0,9538CD9793...
```

The final 32-digit number is the link key, which you could use in future to connect securely without specifying a PIN code.

Now that the devices are paired, use the Bluetooth Manager on your PC to connect to BlueMatik. The following message will appear:

```
+BMSC:B,0
```

```
+BRFC:800,46,B939B0,0,0,0
```

```
+BMSC:3,3B
```

These indicate that the device has connected. Start another HyperTerminal session, using the COM port number assigned by the Bluetooth Manager when you made the connection. The baud settings are ignored, so enter anything you like for them.

To send data to the first HyperTerminal, type into the second console (the one you just created) and observe that the text appears on the first console also. The MUM light does not extinguish, indicating that the text is data rather than a command response from BlueMatik.

To send data from the first HyperTerminal, switch SW6 to the *Data* position so that BlueMatik knows

that you wish to send data. Then type into the first console and observe that the text appears on the first console also.

To disconnect the connection, switch SW6 back to the *Cmd* position and type the following command:

```
AT+BDIS
```

BlueMatik will respond with

```
+BRFC=0,0,0,...
```

This indicates that the connection has ended.

Toothpick Stamp Edition

General Setup

Insert the Toothpick Stamp Edition in the evaluation board so that the antenna overhangs the edge of the board. Insert a BASIC Stamp in the evaluation board. There should be nothing inserted in the LinkMatik and BlueMatik sockets. Remove any existing links and then insert links over the following configuration pins:

A1 - B1 (4k7 pull-up on Data pin)
E6 - F6 (TxD to its LED)

To program the Stamp from Toothpick pins CCP2, CCP3 and CCP4, insert links over the following configuration pins:

C6 - D6 (CCP4 to ATN)
C8 - D8 (CCP2 to Sin)
C9 - D9 (CCP3 to Sout)

To program the Stamp from the serial port, insert links over the following configuration pins:

A2 - B2 (DSR to RTS on RS232)
A4 - B4 (RS232 TxD to Sin)
A5 - B5 (RS232 RxD to Sout)
A7 - B7 (RS232 DTR to ATN)
C5 - C6 (CCP4 to rotary switch)
C7 - D7 (CCP3 to its LED)
C10- D10 (CCP2 to its LED)

(II) Programming the Stamp

To perform the tutorial *Programming the Stamp from Toothpick Stamp Edition*, remove any existing links and then connect the links as follows:

A1 - B1 (4k7 pull-up on Data pin)
E6 - F6 (TxD to its LED)
C6 - D6 (CCP4 to ATN)
C8 - D8 (CCP2 to Sin)
C9 - D9 (CCP3 to Sout)

You can then follow the tutorial exactly as detailed in the ToothPIC Stamp Edition data sheet.

(III) Sending Commands

To perform the tutorial *Sending Commands to the Toothpick Stamp Edition*, keep the links from the previous section.

You can follow the tutorial exactly as detailed in the ToothPIC Stamp Edition data sheet. Note that the TxD LED will light more or less continuously because the Toothpick TxD pin is usually in the high state.

(IV) Controlling Toothpick I/O

To perform the tutorial *Controlling Toothpick I/O*, keep the links from the previous section.

For this tutorial, there is no need to connect an LED to CCP1 since the evaluation board does this for you. However, it would be better to monitor the voltage of the AN0 pin rather than the AN11 pin, since this has a variable resistor connected to it. To do this, open the program `IOComms.bsp` and locate the following line:

```
SEROUT TxPinNo, Baud, [ $02, $04, $1B ]
```

The tutorial tells you to change the \$02 to \$03. If, in addition, you change the \$1B to \$10, you will measure the value of AN0 rather than AN11. You can control the voltage on this pin using the variable resistor marked AN0, closest to the Stamp.

(V) Managing Bluetooth Comms

To perform the tutorial *Managing Bluetooth Communications*, keep the links from the previous section.

It would be better to monitor the voltage of the AN0 pin rather than the AN11 pin, since this has a variable resistor connected to it. To do this, open the program `BTComms.bsp` and locate the following line:

```
SEROUT TxPinNo, Baud, [ $02, $04, $1B ]
```

Change the \$1B to \$10 to measure the value of AN0 rather than AN11. You can control the voltage on this pin using the variable resistor marked AN0, closest to the Stamp.

(VI) Creating User Interfaces

You can follow the tutorial exactly as detailed in the ToothPIC Stamp Edition data sheet.

(VII) Interacting with the User Interface

To perform the tutorial *Interacting with the User Interface*, you will need to program the Stamp using the programming cable. There are two reasons for this. The first is that you will wish to

use the Bluetooth radio for creating the user interface and you can not connect a debug terminal to it at the same time. The second is that you will want to use the CCP3 pin as PWM output pin rather than for programming the Stamp.

Remove any existing links and then connect the links as follows:

E6 - F6	(TxD to its LED)
A1 - B1	(4k7 pull-up on Data pin)
A2 - B2	(DSR to RTS on RS232)
A4 - B4	(RS232 TxD to Sin)
A5 - B5	(RS232 RxD to Sout)
A7 - B7	(RS232 DTR to ATN)
C5 - C6	(CCP4 to rotary switch)
C7 - D7	(CCP3 to its LED)
C10- D10	(CCP2 to its LED)

You can follow the tutorial exactly as detailed in the ToothPIC Stamp Edition data sheet.

Contact Details

Sales

ToothPIC Stamp Edition is distributed and supported by:



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Other FlexiPanel Bluetooth products are distributed by:



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