Special Lecture

Basic Stamp 2 Programming

(Presented on popular demand)
Programming Environment
Servo Motor: How It Work?

• The editor window consists of the main edit pane with an integrated explorer panel to its left, as shown above.
• The main edit pane can be used to view and modify up to 16 different source code files at once.
# Servo Motor Wiring

<table>
<thead>
<tr>
<th>Syntax Element</th>
<th>Text Color</th>
<th>Character Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>Blue</td>
<td>Upper Case</td>
</tr>
<tr>
<td>Comment</td>
<td>Green</td>
<td>No Change</td>
</tr>
<tr>
<td>Constant - Binary</td>
<td>Default</td>
<td>No Change</td>
</tr>
<tr>
<td>Constant - Decimal</td>
<td>Default</td>
<td>No Change</td>
</tr>
<tr>
<td>Constant - Hexadecimal</td>
<td>Default</td>
<td>No Change</td>
</tr>
<tr>
<td>Constant – Predefined</td>
<td>Purple</td>
<td>Upper case</td>
</tr>
<tr>
<td>Constant – String</td>
<td>Red</td>
<td>No Change</td>
</tr>
<tr>
<td>Operators</td>
<td>Default</td>
<td>Upper case</td>
</tr>
<tr>
<td>Declaration</td>
<td>Default</td>
<td>Upper Case</td>
</tr>
<tr>
<td>Directive, Conditional Compile</td>
<td>Gray (Bold)</td>
<td>Upper case</td>
</tr>
<tr>
<td>Directive, Editor</td>
<td>Teal (Bold)</td>
<td>Upper case</td>
</tr>
<tr>
<td>Directive, Target module</td>
<td>Teal (Bold)</td>
<td>Upper case</td>
</tr>
<tr>
<td>Input/Output Formatter</td>
<td>Navy</td>
<td>Upper case</td>
</tr>
<tr>
<td>Selection</td>
<td>White on Navy</td>
<td>No change</td>
</tr>
<tr>
<td>Search match</td>
<td>Lime on black</td>
<td>No change</td>
</tr>
<tr>
<td>Variable modifier</td>
<td>Default</td>
<td>Upper case</td>
</tr>
<tr>
<td>Variable – predefined</td>
<td>Purple</td>
<td>Upper case</td>
</tr>
<tr>
<td>Variable, type</td>
<td>Default</td>
<td>Capitalize</td>
</tr>
</tbody>
</table>
Servo Motor with BS2

Only when you use AA battery pack

2 servo motors only
Need another capacitor for additional servo motors
Sample Code

Automatic line numbers can be enabled or disabled via the “Show LineNumbers” checkbox on the Preferences → Editor Appearance tab.

Bookmarks can be enabled or disabled via the “Show Bookmarks” checkbox on the Preferences → Editor Appearance tab. The bookmarks appear in the gutter as small numbered icons, providing a way to mark lines or sections of code that you need to navigate to quickly or repeatedly. You can define up to nine bookmarks by clicking on the gutter where you want one placed,
PWM

- The BASIC Stamp Editor supports all of the BASIC Stamp models, and all versions of the PBASIC programming language. Compiler directives must be placed in each program to indicate the desired BASIC Stamp model and language version.

' {$STAMP BS1}' 'This indicates to use a BASIC Stamp 1 module
' {$STAMP BS2}' 'This indicates to use a BASIC Stamp 2 module
' {$STAMP BS2e}' 'This indicates to use a BASIC Stamp 2e module
' {$STAMP BS2sx}' 'This indicates to use a BASIC Stamp 2sx module
' {$STAMP BS2p}' 'This indicates to use a BASIC Stamp 2p module
' {$STAMP BS2pe}' 'This indicates to use a BASIC Stamp 2pe module
' {$STAMP BS2px}' 'This indicates to use a BASIC Stamp 2px module
The Memory Map is divided into two sections, the RAM map and the EEPROM map. The RAM map shows how much of each register has been allotted to program variables. The RAM legend details how much is used by I/O Pins, Word, Byte, Nibble and Bit variables, and how much is unused. The main view is the detailed EEPROM map, which displays the data in hexadecimal format in each location.
The Basic PWM Control

The Debug Terminal window provides a convenient display for data received from a BASIC Stamp during run-time, and also allows for the transmission of characters from the PC keyboard to the BASIC Stamp. The Debug Terminal is automatically opened and configured when a PBASIC program, containing a DEBUG command, is downloaded. You can manually open a Debug Terminal one of three ways: select Run → Debug → New, press Ctrl+D on the keyboard, or click on the Debug Terminal toolbar button. Up to four (4) Debug Terminals can be open at once (on four different ports) and all can be left open while editing and downloading source code.
The BASIC Stamp Editor includes searchable, indexed help files.

Access Help by selecting Help → Contents or Help → Index.
Stepper Motor with BS2

ULN 2803 high-current transistor driver
## Motor Experiments

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<td>Robotics</td>
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<tr>
<td>StampWorks</td>
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<tr>
<td>Others</td>
<td></td>
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Lecture 9

555 Timer
Pulse Generation

• Pulsout
  – Software version of pulse generation
  – Pulsout pin, Period
    • Pin: specified I/O pin from 0 to 15
    • Period: 2 µsec per each unit

• 555 Timer
  – Hardware version of pulse generation
  – BS2 can do other works
  – Microcontroller is not necessary
555 Timer

• Highly stable devices for generating accurate time delay or oscillation
• Not programmable
• Controlled by resistors and capacitors
• Applications
  – Pulse generation
  – PWM
  – Time delay generation
555 Timer Block Diagram

circuit diagram of a 555 timer with labels for each component
Connection Diagram
555 Timer without BS2

Connect to P1
555 Timer with BS2

[Diagram of a 555 timer circuit with BS2, showing connections and components such as LED, potentiometer, and capacitors.]
Astable Operation 1

The diagram shows a 555 timer circuit with the following components:
- $V_{CC} = 6V$
- $R_1 = 10K$
- $R_2 = 20K$
- $C = 680 \text{nF}$
- $C_{out} = 0.01 \mu F$

The output voltage $V_{out}$ is shown with $V_{CC} = 1.5V$, $V_{out} = 0.1V$, $V_{CC} = 6V$, $V_{out} = 2V$, $V_{out} = 4V$.

The timing cycle is indicated with $t_{low} = 9.4 \text{ ms}$ and $t_{high} = 14.1 \text{ ms}$. The circuit is powered by a 6V power supply.
Calculation of Duty Cycle

\[ t_{\text{low}} = 0.693 \times R_2 C \]

\[ t_{\text{high}} = 0.693 \times (R_1 + R_2) C \]

Duty cycle \[ = \frac{t_{\text{high}}}{t_{\text{high}} + t_{\text{low}}} \]

\[ f = \frac{1}{t_{\text{high}} + t_{\text{low}}} \]
Calculation of Duty Cycle

\[ t_{low} = 0.693(20K)(680nF) = 9.6ms \]
\[ t_{high} = 0.693(10K + 20K)(680nF) = 14.1ms \]

\[ \text{Duty cycle} = \frac{14.1ms}{14.1ms + 9.6ms} = 0.6 \]

\[ f = \frac{1}{14.1ms + 9.6ms} = 42Hz \]
Astable Operation 2

Frequency vs. C, R₁ and R₂

- Capacitance (μF)
- Frequency (Hz, kHz)

- 1kΩ
- 10kΩ
- 100kΩ
- 1MΩ
- 10MΩ
Applications 1

- It will sound an alarm if it gets too dark all over sudden
- The LDR enables the alarm when light falls below a certain level
Applications 2

• This circuit can be used as a audible 'Power-out Alarm'

• When the line voltage fails, the tone will be heard in the speaker
Applications 3

- Actually really a alarm circuit, it shows how to use a 555 timer and a small glass-encapsulated mercury switch to indicate 'tilt'.
Applications 4

- A Metronome is a device used in the music industry.
- It indicates the rhythm by a 'tic-toc' sound which speed can be adjusted with the 250K potentiometer.
# 555 Timer Experiments

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