



Modtronix SBC45EC Web Server V2.03

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1 Introduction

The SBC45EC is programmed with the Modtronix SBC45EC Web Server when shipped. This application note describes how to use, configure and compile the Modtronix SBC45EC Web Server.

2 Installation

All source code and compiled source files are contained in the *websrvr45_v203.zip* file that can be downloaded from www.modtronix.com/products/sbc45ec. After downloading, unzip it to a location on your computer, for example "c:\modtronix\sbc45ec". All future references in this document will assume that the Modtronix SBC45EC Web Server has been installed in this folder.

3 Structure

After installation, the following folders will have been created in the installation directory:

..\websrvr45_v203	This folder contains the MPLAB project files, and after compiling the project, will contain the generated firmware hex files.
..\websrvr45_v203\src	This folder contains the project specific source files.
..\websrvr45_v203\src\mxmctcpip	This folder contains the Modtronix TCP/IP Stack source code.
..\websrvr45_v203\src\webpages	This folder contains executable and bat files for building the Modtronix SBC45EC Web Server's Web pages. After compiling the Web pages with the "doall.bat" batch file, the generated MPFS format file will be located in this folder – "default.bin". This file has to be uploaded to the EEPROM on the SBC45EC.
..\websrvr45_v203\src\webpages\default	This folder contains the source code for the Modtronix SBC45EC Web Server's Web pages. All source files have to be in a single directory.

4 Details

The Modtronix SBC45EC Web Server implements a HTTP server. It is implemented as a cooperative task that co-exists with the Modtronix TCP/IP Stack and the user's main application (*mxwebsrvr.c* in this case). The Server itself is implemented in the source file "HTTP.c", with a user application implementing two callback functions. The application source file, "mxwebsrvr.c", should be used as a template for the user to create his/her own Web Server application. The HTTP Server provided here does not implement all HTTP functionality; it is a minimal server targeted for embedded system. The user can easily add new functionality as required. The HTTP Server incorporates these main features:

- Supports multiple HTTP connections
 - Contains a simple file system (MPFS)
 - Supports Web pages located in either internal program memory or external serial EEPROM
 - Includes a PC-based program to create MPFS images from a given directory
 - Supports the HTTP method "GET" (other methods can be easily added)
 - Supports a modified Common Gateway Interface (CGI) to invoke predefined functions from within the remote browser
 - Supports dynamic web page content generation
- The server consists of the following main components:
- MPFS Image Builder
 - MPFS Access Library
 - MPFS Download Routine (implemented by the main application)
 - HTTP Server Task

At delivery, the Modtronix SBC45EC Web Server has the following default network settings:

- IP Address: 10.1.0.1
- Gateway Address: 10.1.0.1
- Subnet Mask: 255.0.0.0
- DHCP disabled

These default values will probably have to be changed for the Web Server to work on your network. For details, refer to the *Configuration* chapter of this document.

5 Modifying and Compiling the Firmware

The Modtronix SBC45EC Web Server consists of 2 MPLAB projects, one for the Hi-Tech PICC18 compiler (htmxwebee.mcp) and the other for the Microchip MPLAB C18 compiler (mpmxwebee.mcp). To recompile the project, you must have MPLAB and either of the two above mentioned compilers installed. A full functioning version of the MPLAB C18 compiler can be downloaded from Microchip's site, and can be used for 60 days. A free student version of the MPLAB C18 compiler can also be downloaded, and can be used for commercial and non-commercial use. The code generated with the student version is about 15% larger than that generated with the purchased version of the C18 compiler. Apart from the larger code, the student version generates perfectly working code, and is a great free compiler!

Open one of the two MPLAB projects in MPLAB, and press on the “build all” button. The whole project will be built, and the generated hex file placed in the “..\websrvr45_v203” folder.

The source code is contained in two folders.

- The “..\websrvr45_v203\src” folder contains project specific files and defines. The “projdefs.h” files for example, will define which TCP/IP stack modules are included in the project (DHCP, TCP, UDP...). The project does for example not include DHCP. If DHCP would be required, all that has to be done is to uncommend the “#define STACK_USE_DHCP” line in “projdefs.h” and add the “dhcp.c” file to the MPLAB project. After recompiling, the web server have a DHCP Client built into it.
- The “..\websrvr45_v203\src\mxmctcpip” folder contains all the Modtronix TCP/IP stack code. This code is the same for all projects, and should not be modified. Only project specific files should be modified to customize each project. It is **very important** that no files in this folder be modified, this will allow this folder to be replaced with future versions of the Modtronix TCP/IP stack. To upgrade the Modtronix TCP/IP stack, replace this folder with the latest stack downloaded from the Modtronix web site.

The Modtronix TCP/IP stack is a modified versions of the Microchip TCP/IP Stack (v2.20.04.01), and is described in detail in Microchips's Application note AN833 which can be downloaded from the SBC45EC's product page – see www.modtronix.com/products/sbc44ec. All changes to this document are described in the Modtronix TCP/IP Stack documentation, that can be downloaded from the same location. So, for up to date documentation of the Modtronix TCP/IP stack, both these documents should be used.

6 Upgrading the Firmware

The firmware is contained in the FLASH memory on the PIC chip. It can be reprogrammed 1000s of times. When recompiling the Modtronix SBC45EC Web Server, the generated hex file (in the ..\websrvr45_v203 folder) has to be programmed onto the PIC chip. To do this, a commercial PIC programmer, and a programming adapter for the SBC44EC is required. For details on programming Modtronix PIC based SBC boards (like the SBC44EC), see www.modtronix.com/picboards/prog.

7 Modifying and Compiling the Web Pages

The Modtronix SBC45EC Web Server stores it's web page's in the external EEPROM, which currently can be up to 64KBytes large (24LC512 for example). All pages of the Web Page have to be in the same directory, and they have to be converted with the *mpfs.exe* program to the MPFS (Microchip File System) format that can be loaded into the EEPROM. See page 83 of AN833 for details.

The “..\websrvr45_v203\src\webpages\default” contains all source files for the Modtronix SBC45EC Web Server's web pages. After compiling the web pages to MPFS file format with the “mpfs.exe” tool (or via the “doall.bat” batch file”), the compiled web pages are placed in the

“..\websrvr45_v203\src\webpages\default.bin” file. This file has to be uploaded to the external data EEPROM on the SBC45EC.

The HTTP Server uses the file “index.htm” as its default Web page. If a remote client (browser) accesses the HTTP Server by its IP address or domain name only, “index.htm” is the default page served. This requires that all applications include a file named “index.htm” as part of their MPFS image. If necessary, the name of this default file can be changed by modifying the compiler definition HTTP_DEFAULT_FILE_STRING in the “http.c” file. It is very important to make sure that none of the Web page file names contain any of the following non-alphanumeric characters:

- single or double quotes (‘ and “)
- left or right angle brackets (< and >)
- the pound sign (#)
- the percent sign (%)
- left or right brackets or braces ([, { ,] and })
- the “pipe” symbol (|)
- the backslash (\)
- the caret (^)
- the tilde (~)

If a file does contain any of these characters, the corresponding Web page will become inaccessible. No prior warning will be given. The HTTP Server also maintains a list of file types that it supports. It uses this information to advise a remote browser on how to interpret a particular file, based on the file’s three-letter extension. By default, the HTTP Server supports the following files:

- *.txt
- *.htm
- *.gif
- *.cgi
- *.jpg
- *.cla
- *.wav

If an application uses file types that are not included in this list, the user may modify the table “httpFiles”, along with corresponding “httpContents” enumerations in the file “http.c”.

8 Upgrading the Web Pages

The web pages served up by the SBC45EC are contained in the external EEPROM chip on SBC45EC. The “..\websrvr45_v203\src\webpages\default” contains all source files for the Modtronix SBC45EC Web Server’s web pages. After compiling the web pages to MPFS file format with the “mpfs.exe” tool (or via the “doall.bat” batch file”), the compiled web pages are placed in the “..\websrvr45_v203\src\webpages\default.bin” file. This file has to be uploaded to the external data EEPROM on the SBC45EC. There are 3 ways of doing this:

1. Program the MPFS image remotely across the network using FTP. See "Uploading an MPFS Image Using the FTP Client" (page 85 of AN833) for more information. The Modtronix SBC45EC Web Server already includes the FTP module, so this method can be used. The FTP user name is “ftp” and the password is “microchip”.
2. Use a programmer application or device supplied by the data EEPROM vendor to program the MPFS image. Always make sure that MPFS image starts after the “Reserved Block” (See page 83 of AN833 for details of reserved block).
3. On power up, enter the configuration mode of the Modtronix SBC45EC Web Server and follow the menu

instructions to program the MPFS image onto the EEPROM – see the configuration part of this document for details.

9 Configuration

At delivery, the Modtronix SBC45EC Web Server is configured with the following network settings:

- IP Address: 10.1.0.1
- Gateway Address: 10.1.0.1
- Subnet Mask: 255.0.0.0
- DHCP disabled

These default values will probably have to be changed for the Web Server to work on your network. There are two ways to configure the SBC45EC.

9.1 Web interface

The simplest way to configure the SBC45EC is via it's web interface. By using a standard web browser, enter “<http://10.1.0.1>” into the web browsers address. This will bring up the web pages contained on the SBC45EC, and allow it to be configured. For further details, see the *Web Pages* chapter later on in this document.

9.2 Serial Configuration

If your network configuration does not allow you to access the SBC45EC via it's default IP address, you might have to first change it via the serial configuration interface. To do this, the SBC45EC must be connected up to a terminal (HyperTerminal for example) via its serial port. The terminal program has to be configured for 57600 baud, 8 bits, 1 stop and start bit, no parity or flow control. At power up, the following message will be displayed for 3 seconds.

```
Press any key for Configuration menu.....
```

If any button is pressed within about 3 seconds, the SBC45EC will enter configuration mode, if not, it will start up the default web page contained in EEPROM memory. When entering configuration mode, the following menu will be displayed:

```
MCHPStack Application v1.1 (MpStack 2.20.04, Feb 15 2004)
```

- ```
1: Change Board serial number.
2: Change default IP address.
3: Change default gateway address.
4: Change default subnet mask.
5: Enable DHCP & IP Gleaning.
6: Disable DHCP & IP Gleaning.
7: Download MPFS image.
8: Save & Quit.
```

```
Enter a menu choice (1-8):
```

#### Serial Number

Allows the serial number to be changed. When selected, it prompts the user for the new serial number:

```
Serial Number (0):
```

#### IP Address

Allows the default IP address to be changed. When selected, it prompts the user for the new IP address:

```
Default IP Address (10.1.0.1):
```

### **Gateway Address**

Allows the default Gateway address to be changed. When selected, it prompts the user for the new Gateway address:

[Default Gateway Address \(10.1.0.1\):](#)

### **Subnet Mask**

Allows the default Subnet Mask to be changed. When selected, it prompts the user for the new Subnet Mask:

[Default Subnet Mask \(255.0.0.0\):](#)

### **Download MPFS Image**

When selected, it prompts the user for the new MPFS image of the web page to be displayed. This must be a file created with the *mpfs.exe* utility with the “/b” option. See page 84 of AN833 for details.

[Ready to download MPFS image - Use Xmodem protocol.](#)

## 10 Web Pages

The following screen shots show the pages of the Modtronix Web Server as generated by a SBC45EC.

### 10.1 Introduction Page

This is the main page that is loaded when requesting the devices home page.

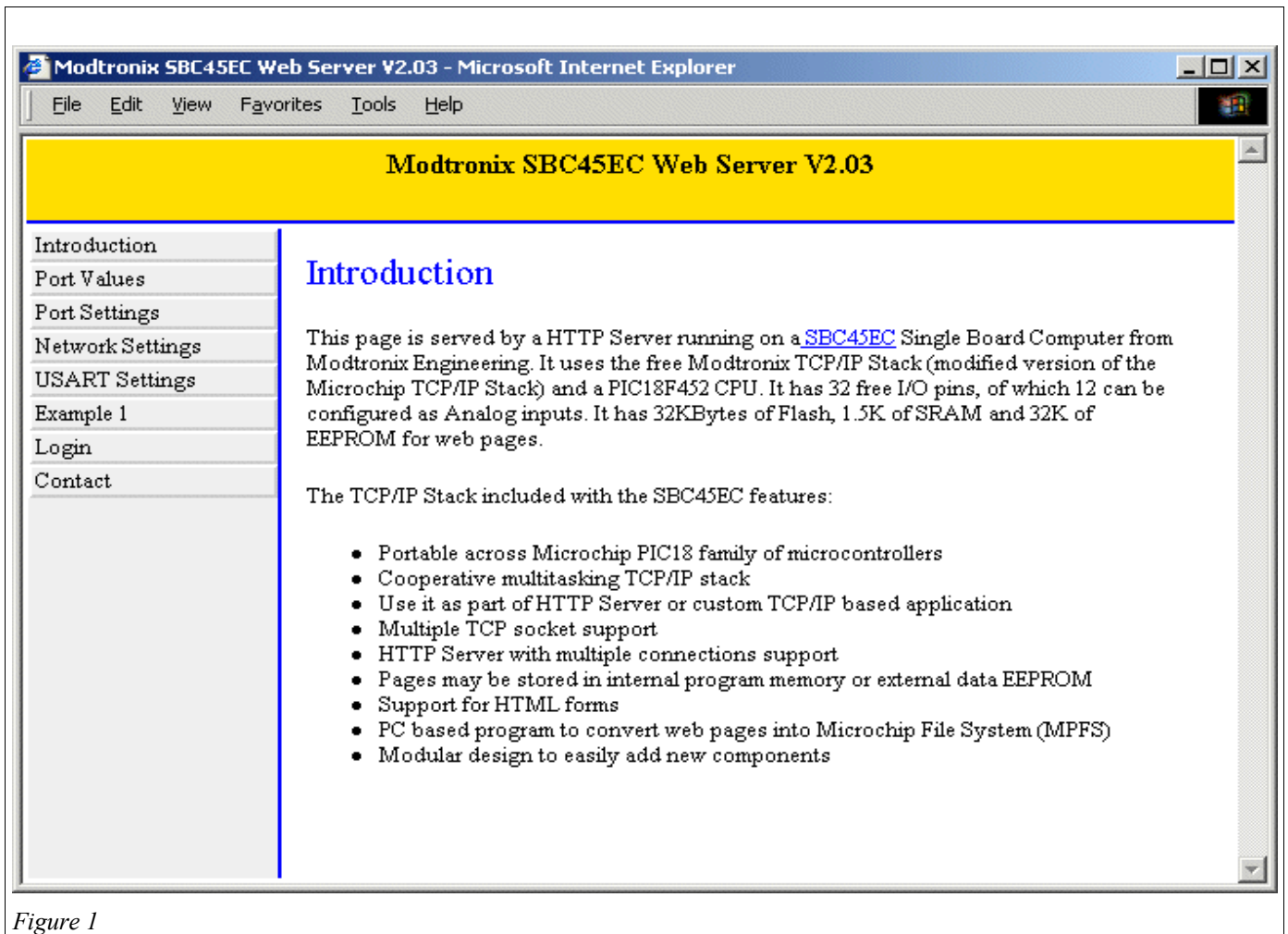


Figure 1

### 10.2 Port Values Page

This page gives some examples how to display and modify the state of the PIC's Digital port pins. Pins that are configured as outputs automatically get assigned a toggle button by the web server. When pressing the button, the corresponding port pin on the PIC will be toggled, and the text on the button will change to represent the new value of the PIC's port pin. In this example, ports C0, C1 and C2 are configured as outputs, all the rest are configured as inputs. See *Port Settings* page for details on configuring port pins.

**Modtronix SBC45EC Web Server V2.03**

Introduction  
 Port Values  
 Port Settings  
 Network Settings  
 USART Settings  
 Example 1  
 Login  
 Contact

## PIC Digital Pin Values

**Port Values:**  
 This section is used to monitor and set the digital port pins of the CPU.

- Output pins are represented by a button with a 1 or 0 on it. When pressed, the output will be toggled.
- Input Pins can only be monitored, and are represented by a 1 or 0 character.

| Port Pin | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|---|---|---|---|---|---|---|---|
| Port A:  |   |   |   |   |   |   |   |   |
| Port B:  | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Port C:  |   |   | 0 |   |   | 0 | 0 | 0 |

Update

The HTML document will have a %pxy tag where it wants to display a Digital PIN's state. The 'p' part represents the port name, and can be **a, b, c** or **f**. The 'x' part represents the format of the displayed PIN and the 'y' part the PIN number (0 to 7). Valid formats are:

- 0 - Outputs **1** or **0**, representing the PIN's state.
- 1 - Outputs **on** or **off**, representing the PIN's state.
- 2 - Outputs <!-- if PIN is configured as an input.
- 2 - Outputs --> if PIN is configured as an input (Add 0x08 to y part - pin number).
- 3 - Outputs <!-- if PIN is configured as an output.
- 3 - Outputs --> if PIN is configured as an output (Add 0x08 to y part - pin number).

For example:

- To display 1 or 0 to represent RB5, place **%b05** on your page.
- To display on or off to represent RF7, place **%f17** on your page.
- To print --> if RA4 is an input, place **%a2C** on your page (note the y part is the pin number + 8 in hex = 4 + 8 = C).

Figure 2

### 10.3 Port Settings Page

This page is used to configure which of the PIC's Port Pins will be inputs and which outputs. All pins configured as outputs will automatically be assigned a toggle button in the *Port Values* page that will enable their state to be toggled.

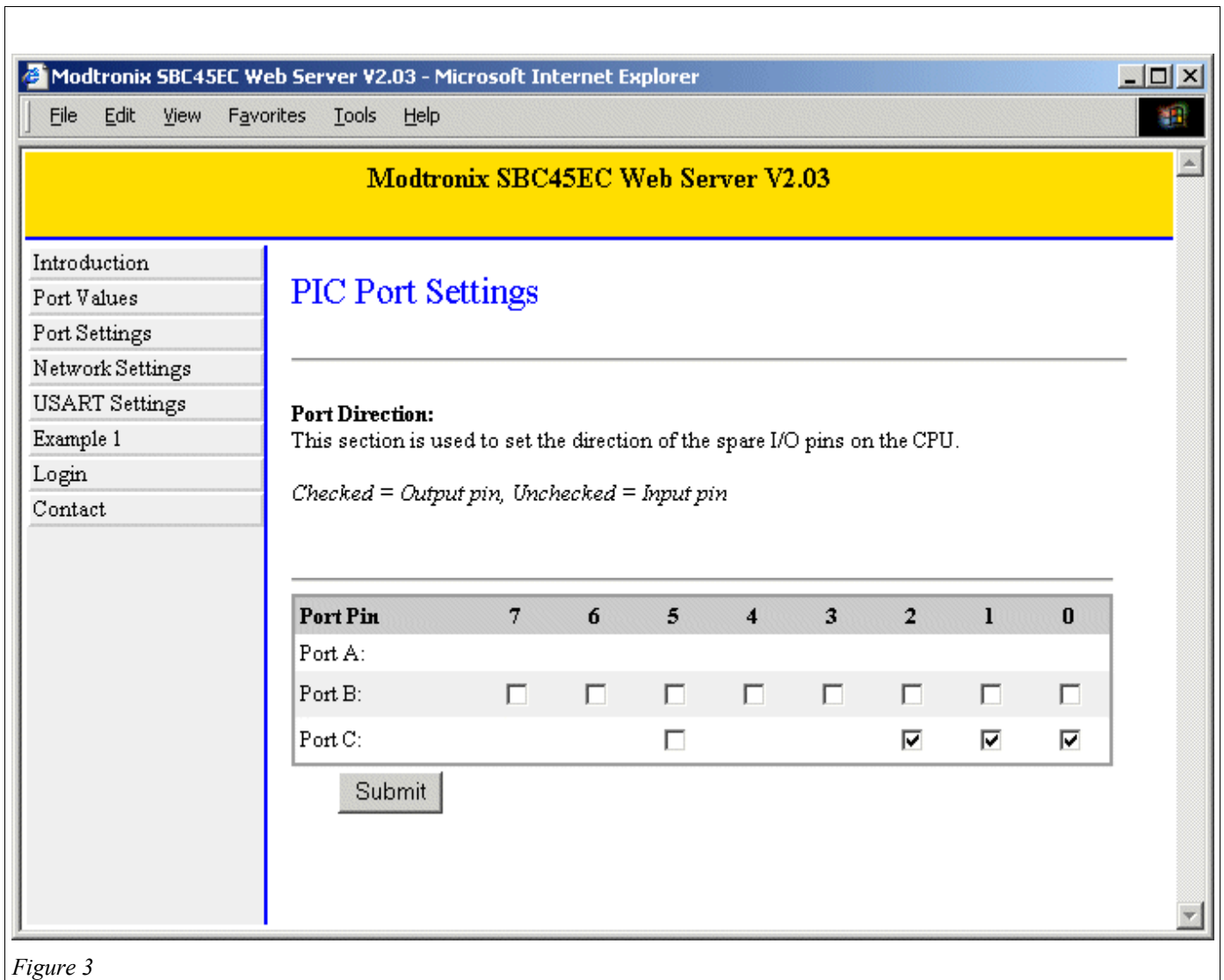


Figure 3

## 10.4 Network Settings Page

This page is used to configure the network settings for this device. It is VERY IMPORTANT to assign each device a unique MAC address if multiple devices will be used on the same network. Only the end fields should be changed. For example, if 10 SBC45EC are to be used on the same network, give the first one the MAC address “0.4.163.0.0.0”, the second one “0.4.163.0.0.1” ..... and the last one the address “0.4.163.0.0.9”.

To change the MAC address , the user must be logged in as super user:

1. Go to the *Login page*.
2. Enter *mxsuper* as username and *pw* as password.
3. Return to this page. The MAC address will now be editable.

The screenshot shows a web browser window titled "Modtronix SBC45EC Web Server V2.03 - Microsoft Internet Explorer". The page content includes a yellow header with the title "Modtronix SBC45EC Web Server V2.03". On the left is a navigation menu with items: Introduction, Port Values, Port Settings, Network Settings (highlighted), USART Settings, Example 1, Login, and Contact. The main content area is titled "Network Settings" and contains the following form fields:

- IP Address: 10 . 1 . 0 . 1
- Subnet Mask: 255 . 0 . 0 . 0
- Gateway Address: 10 . 1 . 0 . 1
- MAC Address: 0 | 4 | 163 | 0 | 0 | 0

Below the fields is a "Submit" button and a message: "To change MAC address, please log in!".

Figure 4

## 10.5 USART Settings Page

This page allows the BAUD rate of USART 1 to be configured. The default baud rate is 57600.

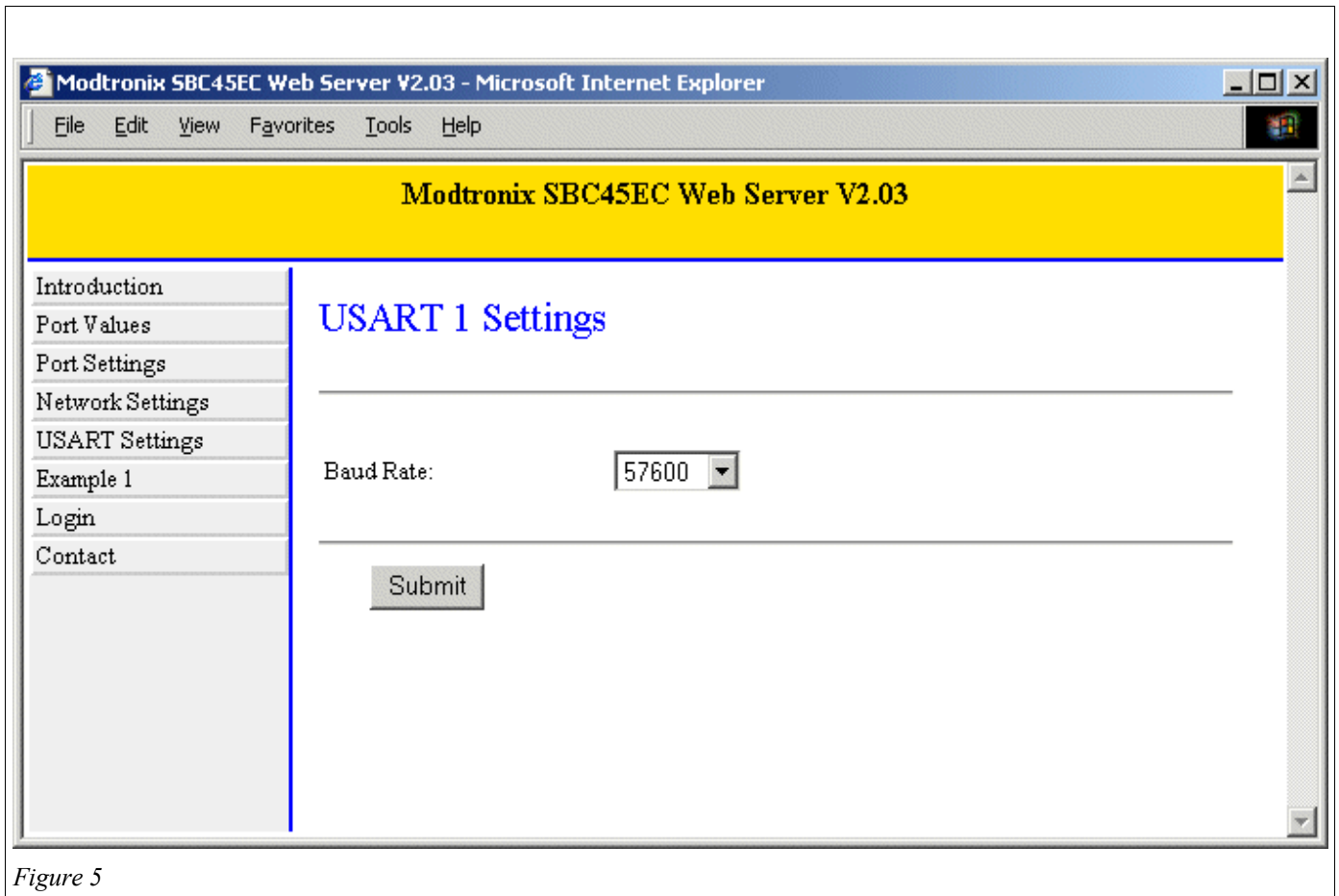


Figure 5

## 10.6 Login Page

This page represents a simple login mechanism. There are 3 levels of users, Guest, Admin and Super. The default user names and passwords are:

- *mxadmin* and *pw* for Admin user.
- *mxsuper* and *pw* for Super User.

When not logged in, the user will be Guest. When modifying the Web server code, the user can assign certain settings to only be editable for certain users. For example, in the default web server, the Network MAC address is only editable by the super user.

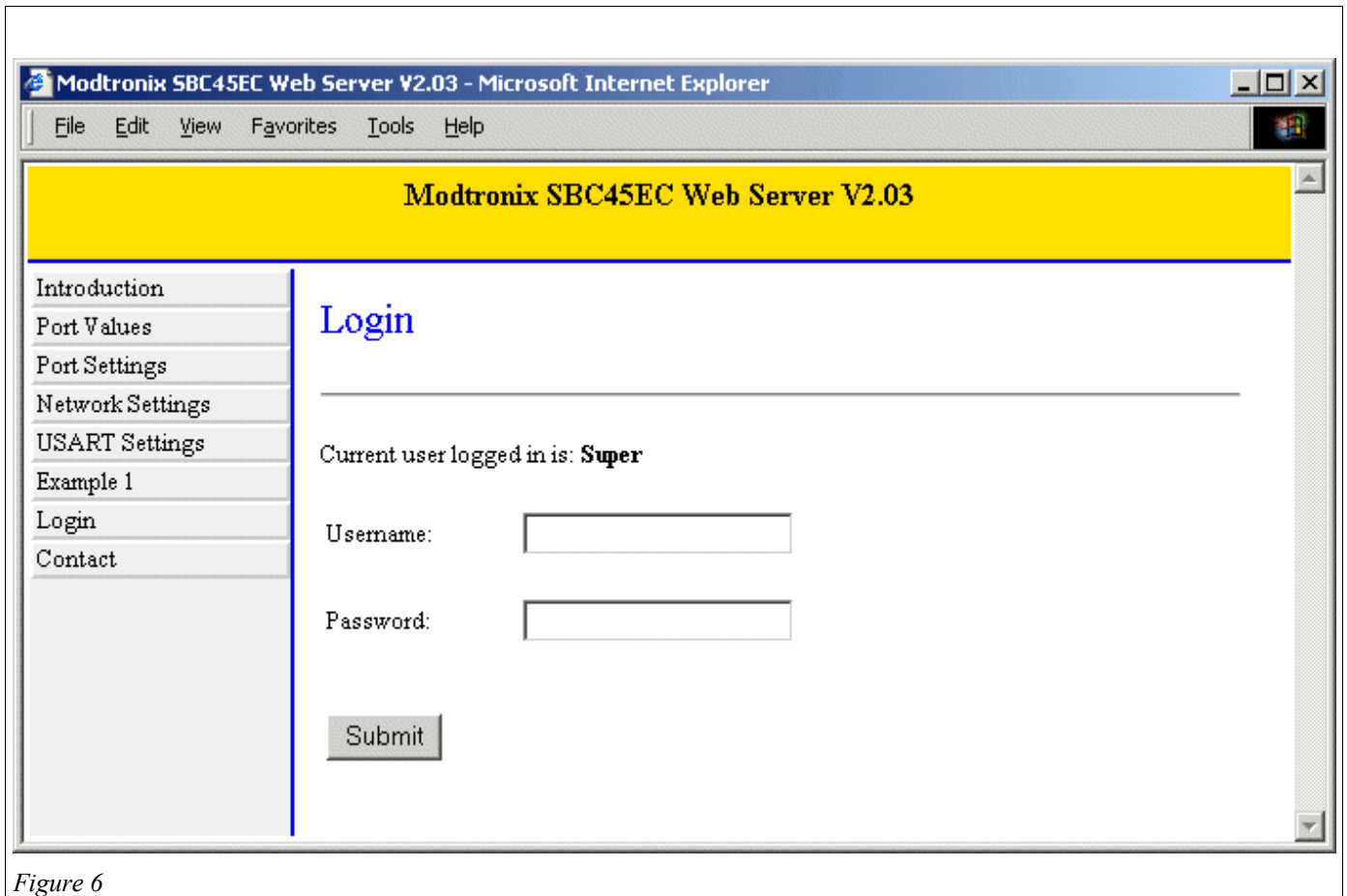


Figure 6

## 10.7 Contact Page

This page contains contact details.

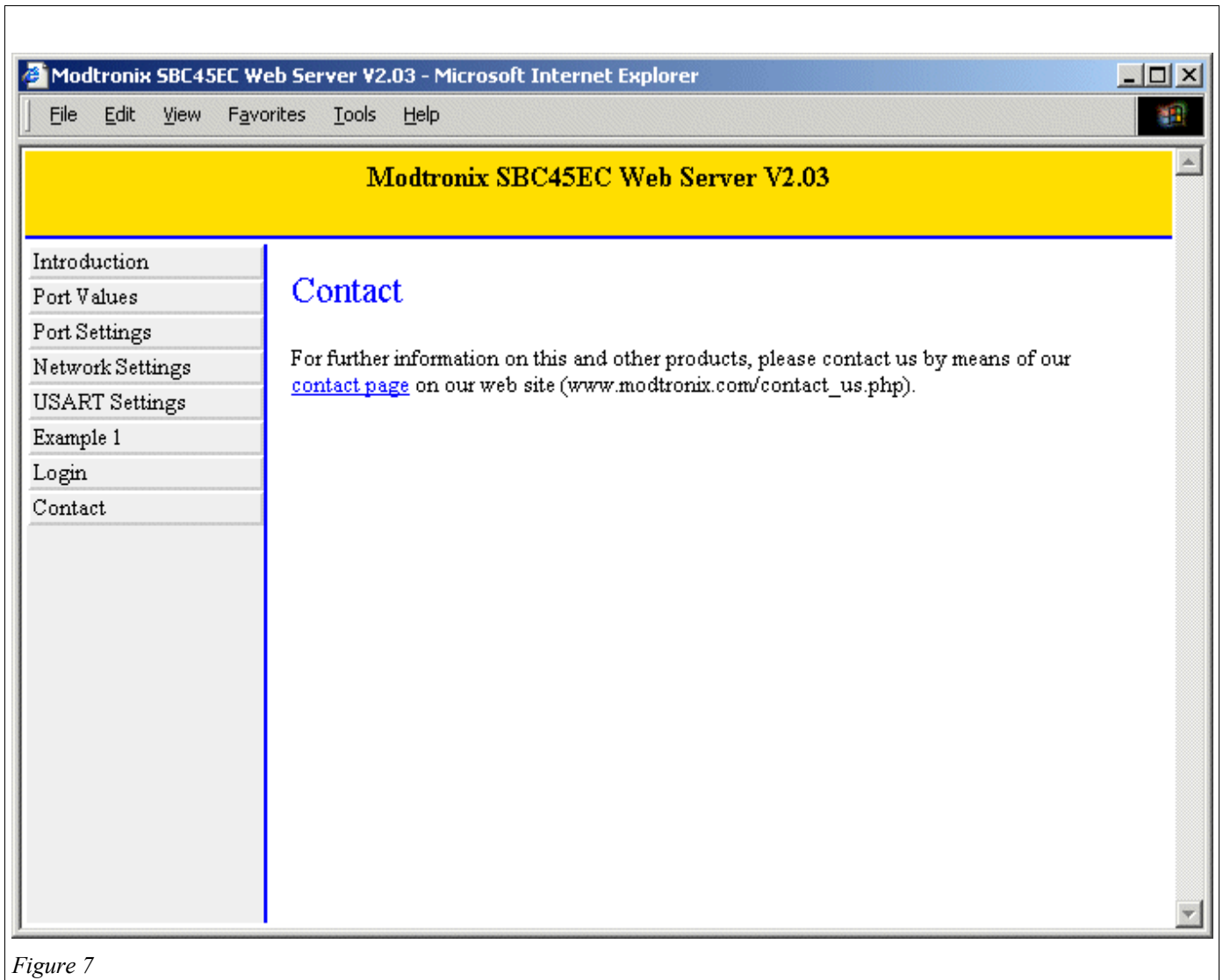


Figure 7