

Getting Started

with the

Proton-NET Development Board

and the

Iosoft Demo Firmware P16WEB V2.02c

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Proton-Net & Iosoft Firmware for Embedded TCP/IP Development

Introduction

The Crownhill Proton-Net development system supports the development of embedded TCP/IP hardware and software, with particular reference to Microchip PIC16F8xx and 18xxx microcontroller family, and the 'C' programming language.

This manual describes set up of the Proton-Net hardware, and the iosoft firmware that is supplied on the Proton-Net CDROM for software information, please refer to the manual supplied with the source-code package available from www.crownhill.co.uk and www.iosoft.co.uk

It is assumed that the reader has a reasonable familiarity with TCP/IP networking and PICmicro® microcontrollers as described in 'TCP/IP Lean: Web Servers for Embedded Systems' by Jeremy Bentham (2nd edition ISBN 1-57820-108-X). This document should be read in conjunction with the above mentioned book.

Attention should be paid to the following if successful implementation of the demonstration is to be achieved.

- ADDRESSING - Each device on the network must have a unique address. Networks using Dynamic Host Configuration Protocol (DHCP) may not permit single devices with fixed IP addresses without configuration changes.
- EXPERIMENTATION - The Proton-Net development board is capable of generating a high volume of network traffic, which may severely disrupt normal network operations.
- CONNECTION - The Proton-Net is best tested and initially configured whilst connected directly to a dedicated host system, using the supplied crossover cable; or connected via a standard Ethernet cable to a single Ethernet hub, which has no connections to any other LAN.
- NUMBER - If more than one Proton-NET board is being used on the same network, each board **MUST** have a different IP address and serial number - even if only one is connected at a time. The host system may become confused with different Ethernet IDs (serial numbers) being linked to a single IP address.
- RECONFIGURATION - Changes in Ethernet IDs and/or IP addresses, especially when more than one board is being used, may cause a situation where the boards respond erratically. This is likely due to ARP caching by the host system, where it retains a mapping of MACs and IP addresses.

2. Host System Requirements

To configure and communicate with the Proton-NET board, you must have a system that meets the following hardware and software requirements:

- PC-compatible system with an Intel Pentium® class, or higher processor, or equivalent
- 4 MB RAM (16 MB or more, recommended)
- CD-ROM drive (for use with the accompanying CD)
- Standard Ethernet card (10 Mbps) with RJ45 (10-Base T) connector
- One available standard serial port, with a matching COM port available through the operating system
- Microsoft Windows 95, Windows 98, Windows NT 4.0 or Windows 2000 Professional Desktop (any version)
- A terminal emulation package, such as HyperTerminal®

2.1 Setting Up the Test System

Assuming that an Ethernet card has already been installed and is working properly in the Host system, and that the TCP/IP protocol has been installed and bound to the card. The simplest configuration uses a single host computer connected directly to the Proton-NET board using a crossover cable. Creating this isolated test system involves the following steps:

1. Connect the Proton-NET board to the host system via the crossover cable
2. Configure the Host
3. Configure the Proton-NET

Assuming that you have connected the Proton-Net board to your host system via the crossover cable supplied with the Proton-Net development system, you must configure the host system: It is recommended that a 'scratch' network be created for test purposes, and that this network be isolated from all other networks in the building. This ensures that your experimentation will not disrupt the activities of other network users.

For initial testing, a PC with a spare serial port and Ethernet interface is needed. The PC should have TCP/IP networking enabled, and be set to a fixed ('static') IP address. It should be isolated from the main office network, so can be assigned a suitable IP address for a machine not connected to the Internet, e.g. 192.168.0.10. To set this address in Windows, edit the TCP/IP Network Properties for the Ethernet interface you're using, and set to:

IP address: 192.168.0.10

Subnet mask: 255.255.255.0

To test the Proton-Net, any IP address may be used, but it is important that

- The PC has a fixed address (not obtained 'automatically' using DHCP)
- The PC and the Proton-Net are in the same 'domain', i.e. their IP addresses have the same base value on the left-hand side.

For example a PC at 192.168.0.10 will normally communicate with an Proton-Net Board at 192.168.0.20, but probably not if the address is 10.1.1.20, even though these may be the only two systems on the network. For detailed discussion of IP addressing and domains, refer to the 'TCP/IP Lean' book.

If everything is working correctly, the Tx and Rx lights should be lit or flickering and the LCD display will show a sign on message similar to this:

P16Web V2.02c
192.168.0.20

The actual version of the firmware will be reflected in the first line of the LCD display. The Version may be different to the example shown here.

The IP address "192.168.0.20 is an example the IP address displayed will be set by you later on during setup.

If your Proton-NET does not show the sign on message check all connections with the power supply and the board.

2.2 Setting up the Host IP Address

This process will vary depending on the host system.

In general you will need to select a free IP range i.e 192.168.0.xxx , Set a subnet mask e.g. 255.255.255.0 Ensure that DHCP is not used and that TCP/IP protocol is selected

Be sure to ensure that the host system is on the same domain as the Proton-Net will be If the two addresses are dis-similar, the host system will be looking for an IP 'router' to complete the connection to the proton-NET, even though the electrical connection is fine. A good starting point is 192.168.0.10 for the host and we can then select 192.168.0.20 for the Proton-NET

Assuming that you are using Hyper- Terminal. If you are using another terminal emulation package, the procedure you use to configure a terminal session may differ.

2.3 Configuring the Proton-NET IP Address

From the Start menu:

- Select *Programs*
 - *Accessories*
 - *Communications*
 - *HyperTerminal* (or sometimes, *Programs>Accessories>HyperTerminal*)
- At the initial “Connection Description” dialog box, enter a name for the connection. (You may call the session any name that you want) Click “OK”.
- At the “Connect To” dialog box that follows, choose the appropriate COM port from the drop-down menu. Click “OK”.
- At the COM Properties dialog box that follows, select the settings:
 - Bits per second: 9600
 - Data bits: 8
 - Parity: none
 - Stop bits: 1
 - Flow: none

Click “OK”.

- The terminal window opens with a flashing cursor. The message “Connected” appears in the status bar at the bottom of the terminal window, along with an elapsed time display.
- Press and hold button RB5 on the Proton-Net Board (above the two potentiometers and below the ICD socket. NOT the RESET button) While holding RB5, press and release the RESET button. The terminal responds with:

P16Web V2.02c Config Serial num?

The LCD also displays “P16Web V2.02c Config”.

Note: The actual version of the firmware will be reflected in the first line of the display.

- Enter the serial number (Ethernet ID number) printed on the sticker on the board. Press <ENTER>.
- At the response IP addr?, enter the ip address of the proton-Net Board, this can be any free ip address in the range denoted by the subnet mask, for example, if the original host IP address is 192.168.0.10 , enter “192.168.0.20”. Press <ENTER>.
- The terminal responds with XMODEM?, followed by a series of characters appearing approximately once per second.
- Press and release the MCLR button. The terminal responds with the sign on showing the new IP address entered in the stage above. The LCD also displays “P16Web V2.02c” and the new IP address.
- You may now close the terminal session. You may want to save the setting for future use.

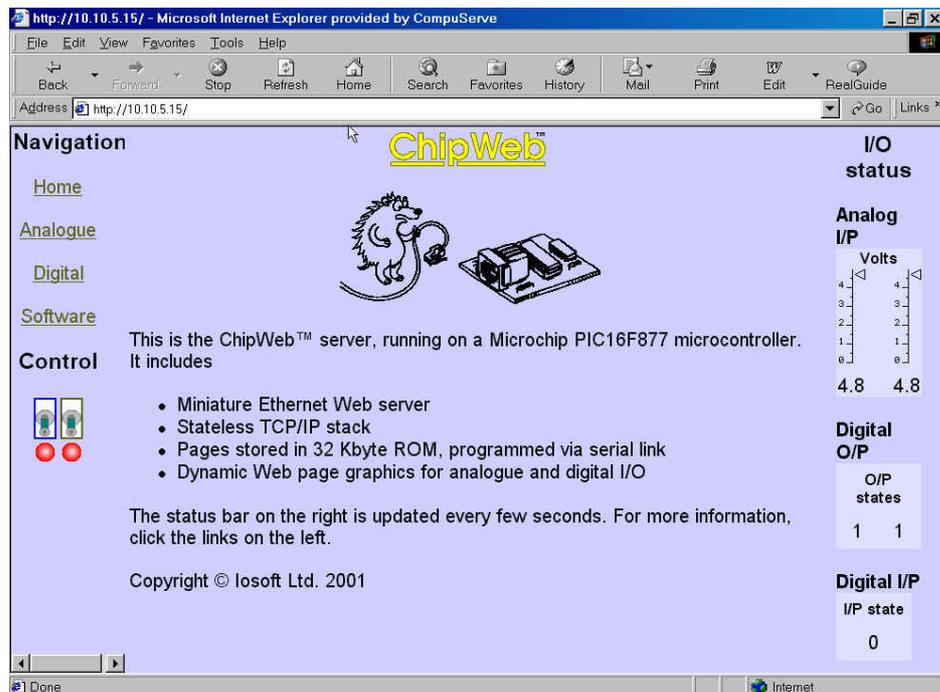
Your Proton-NET development board is now ready for use no further software programming is required. All that remains is to connect to it to view the custom HTML page, stored in the on board eeprom.

However you may need to make some small changes to your browser to view the web page whilst connected directly to the Proton-NET. Check that you are NOT using a proxy server, if you are disable it:

- Access the browser's configuration
- Select the "Connections" tab, then click on the "LAN Settings" button.
- Verify that the "Use a Proxy Server" box is deselected
- Click "OK", then "OK" again to close the Internet Properties dialog box.

Launch the Web browser (if not running already). At the URL address line, enter "http://", and the IP address of the Proton-NET board. Press <Enter>.

You should see a page similar to this:



On the left of the page you will see two toggle switches, when these are clicked they will change the status of the user LED on the Proton-NET board, the status is also reflected on the right of the page under the title Digital O/P. Above which you will see the indication of Analogue I/P deduced from the potentiometer settings on the Proton-Net Board.

You may notice references to PICDEM.NET on the web page, the Proton.NET board was designed in collaboration with Jeremy Bentham, who also worked on the PICDEM.NET board thus they are compatible and the files used on the Proton-NET demo are the same as those used by PICDEM.NET.

2.4 Loading the losoft web demo

On the CDROM shipped with proton-NET, the losoft firmware is provided in compiled format for demonstration purposes. Visit www.iosoft.co.uk for information on the book TCP/IP Lean and the source code license.

The losoft web page, is written in compiled HTML must be loaded into the EEPROM on board the Proton-NET development board. For more information see the book TCP/IP Lean.

The Web page can be reloaded, or a new page loaded in its place, without affecting the operating firmware on the microcontroller. Reloading the Network Configuration, however, does require the Web page to be reloaded.

The LCD also displays “P16Web V2.02c **Config**”.

When running the losoft firmware Proton-NET board will also enter the Configuration mode automatically, whenever an EEPROM checksum failure occurs (e.g., when the EEPROM is cleared or its contents are corrupted).

At this point, the Proton-NET board’s network configuration can be changed as we saw previously.

- At the Serial num? prompt, enter the serial number (Mac address) this may be recorded on the Ethernet ID sticker on the board, or a new Ethernet ID number can be created. Alternatively, press <ESC> to leave the ID unchanged.
- At the IP addr? prompt, enter the new IP address in dotted-decimal notation. Alternatively, press <ESC> to leave the IP address unchanged.
- Press <ENTER>. The new network configuration is now programmed into the controller’s EEPROM.
- The terminal responds with XMODEM
- At the XMODEM? prompt, select *Transfer>Send File* from the main menu for HyperTerminal. Specify the location of the ROM file that you found on the Proton-NET CDROM file, and select “XMODEM” for the Transfer Protocol. When the transfer has finished, the Proton-NET board will return to normal operation automatically. The terminal and LCD return with sign on message “P16Web V2.02c” and the IP address.
- If the transfer did not complete successfully, the Proton-NET board will return to Configuration mode. There may also be an error message from the terminal emulator, noting that the file transfer did not complete. It is also possible that the controller EEPROM checksum has failed, and the network configuration may need to be reloaded

2.5 Loading the Iosoft firmware

On the CDROM shipped with proton-NET, the Iosoft firmware is provided in compiled format for demonstration purposes. You will need to program a 16F877 with the hex file and load the on board eeprom with the ROM image. Visit www.iosoft.co.uk for information on the book TCP/IP Lean and the source code license. You may use any suitable PIC programmer or the ICD connection on the Proton-NET board.

Check the config fuse settings before blowing the device, to quote the book:

Before burning a program into a PIC device, it is important to check that the fuse settings have been propagated correctly to the device programmer; use the following settings for the PIC16:

```
Oscillator:      HS
Watchdog:        disable
Powerup timer:   enable
Brown-out detect: enable
Code protect:    off
Low-volt program: disable
Code protect EE: off
EECON write:     enable
```

The PIC18 settings differ slightly:

```
Oscillator:      HS
OSC enable:      disable
Watchdog:        disable
Code protect:    off
Powerup timer:   disable
Brown-out detect: enable
CCP2 mux:        I/O mux with RC1
STVREN:          cause reset
```

Incorrect fuse settings may cause a complete malfunction (if the PICMicro doesn't run) or subtle problems due to I/O pins being reassigned for other purposes. If a program works using an emulator, but fails when programmed into a device, the configuration settings are probably at fault.

The file WEBPAGE.ROM is an image to be blown into the EEPROM; either via a programmer, or XMODEM