

A Simple Local Area Network Setup for Connecting Multiple TCwebs Using a Low Cost Cable/DSL Router



Figure 1 TCweb Thermocouple Monitor

One of the powerful features of the TCweb Thermocouple Monitor is its built-in Ethernet port and the Web and TCP/IP servers that provide Ethernet (TCP/IP) communications. Using these TCweb features and a low cost cable/DSL router, this application note will show you how to remotely monitor and control your TCweb from anywhere in your factory or over the Internet using Ethernet cable connections. Once connected you can use your Web Browser, Tidal Engineering's free SimpleComm software or your own LabVIEW, Visual Basic or Visual C++ program to monitor and control your networked TCwebs. This application note will guide you through the setup of the Belkin Cable/DSL router, the TCweb and your PC.



Figure 2 Belkin 4 Port Cable/DSL Gateway Router

The diagram below illustrates the hypothetical system described in this AppNote: four TCweb monitors connected to a PC via the Belkin Cable/DSL router.

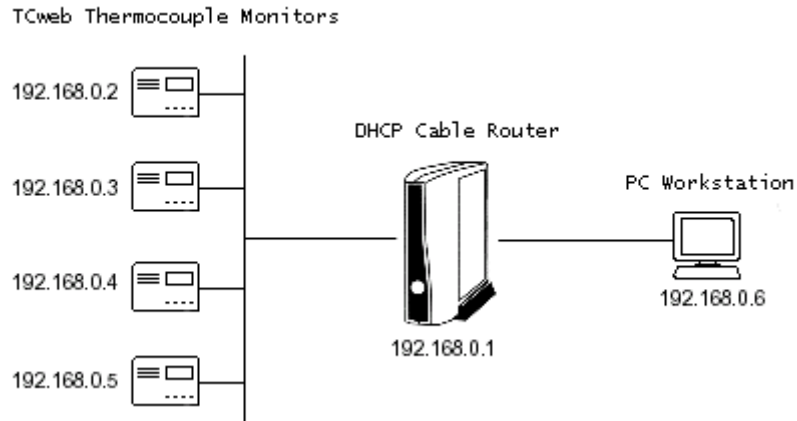


Figure 3 Connection Diagram; Four TCwebs

Setting up the Hardware Connections

Required Equipment

1. PC
 - Ethernet card
 - Windows 9x, NT, 2000 or XP
2. Belkin 4 Port Cable/DSL Gateway Router, Model F5D5230-4
 - DC power supply
3. One or more TCweb Thermocouple Monitors.
4. CAT 5 Ethernet patch cables, one for the PC and one for each TCweb.
(Do not use crossover cables)

Hardware Setup

1. Connect an Ethernet cable from each TCweb's Ethernet port to a LAN port on the router.
2. Connect another cable from a LAN port on the router to your PC's Ethernet port.
3. Plug the connector of the 16 V AC power adapter into the DC adapter socket on the router and then plug the adapter into a wall outlet.

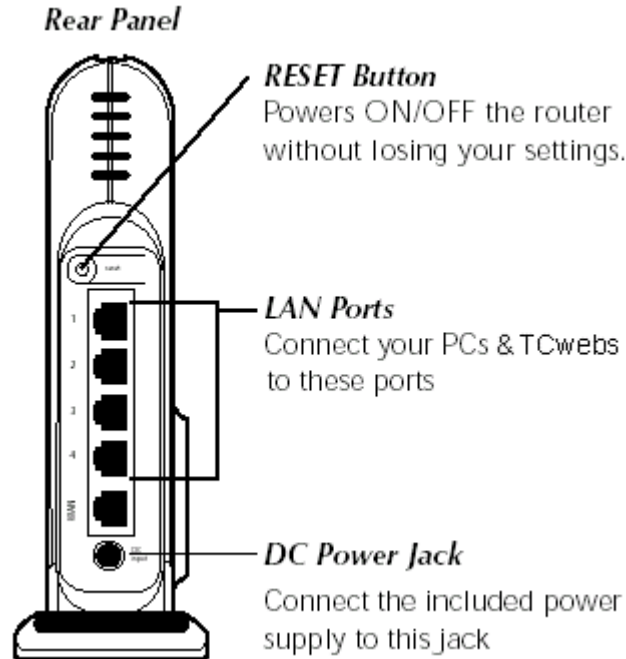


Figure 4 Rear Panel of the Belkin Router

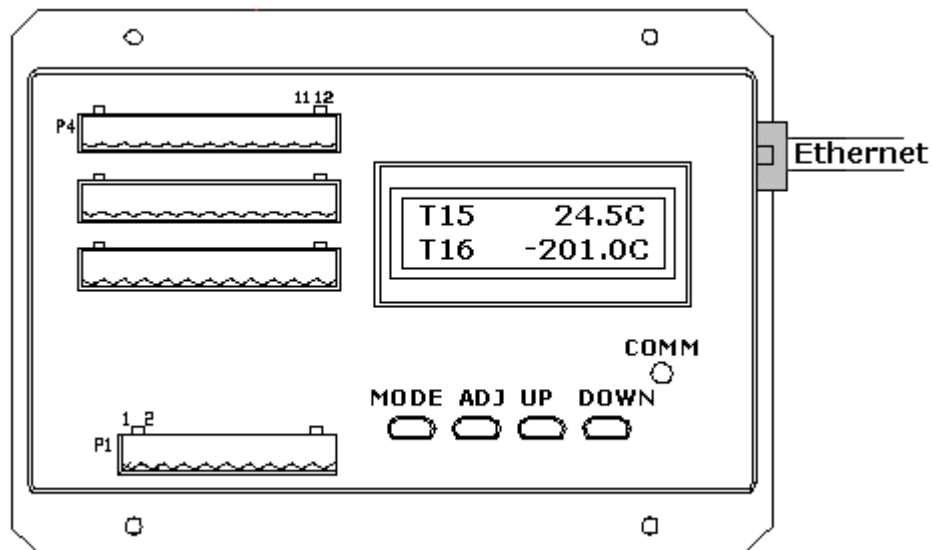


Figure 5 Front Panel TCweb

Setting up the Software

Belkin Cable/DSL Router Software Setup

The Belkin router is set to run in DHCP mode as shipped from the factory and does not need to be changed. Refer to Appendix A or Belkin's documentation to either configure the settings or to reset them to their factory configuration.

PC Software Setup

The PC's network settings can be configured to "Obtain an IP address automatically" from the router for the simplest setup. The following steps show you how to modify your network settings to do this for each operating system.

1. Open your Network Settings or Local Area Connection folder.

Windows 95 98 ME

Go to the Start button and navigate to Settings, Control Panel and click on Network.

Windows NT & 2000

Go to the Start button and navigate to your Network and Dial-up Connections folder. Start, Programs, Accessories, Communications, Settings, Network and Dial-up Connections.

Windows XP

Go to the Start button and navigate to the Control Panel. Click on Network Connections folder and click "Local Area Connection".

The screen below is for Windows 2000. We will walk through the rest of the steps associated with Window NT & 2000 network settings modifications. Window 95, 98 and XP procedures are similar to these steps.

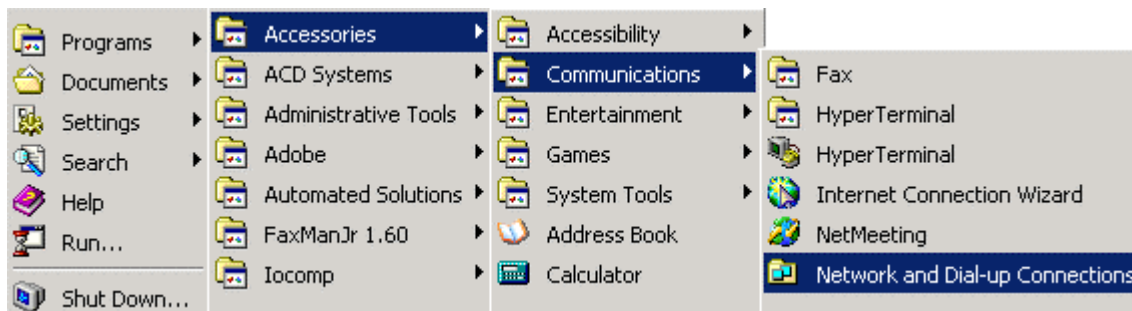


Figure 6 Opening Network Connection Setup Windows

2. After clicking on Network and Dial-up Connections, you will see the screen below. Right click on Local Area Connection and select Properties.



Figure 7 Network And Dial-up Connections

3. Select Internet Protocol (TCP/IP) and press the Properties button.

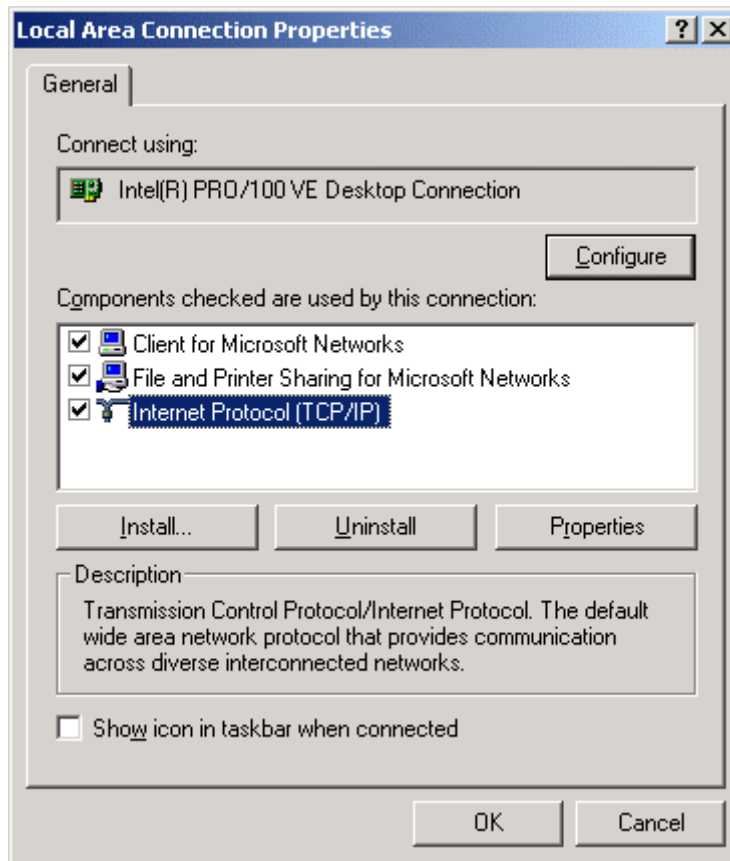


Figure 8 Local Area Connection Properties

4. To enable your PC to accept IP addresses assigned by the router, select the option buttons labeled "Obtain an IP address automatically" and "Obtain DNS server address automatically".

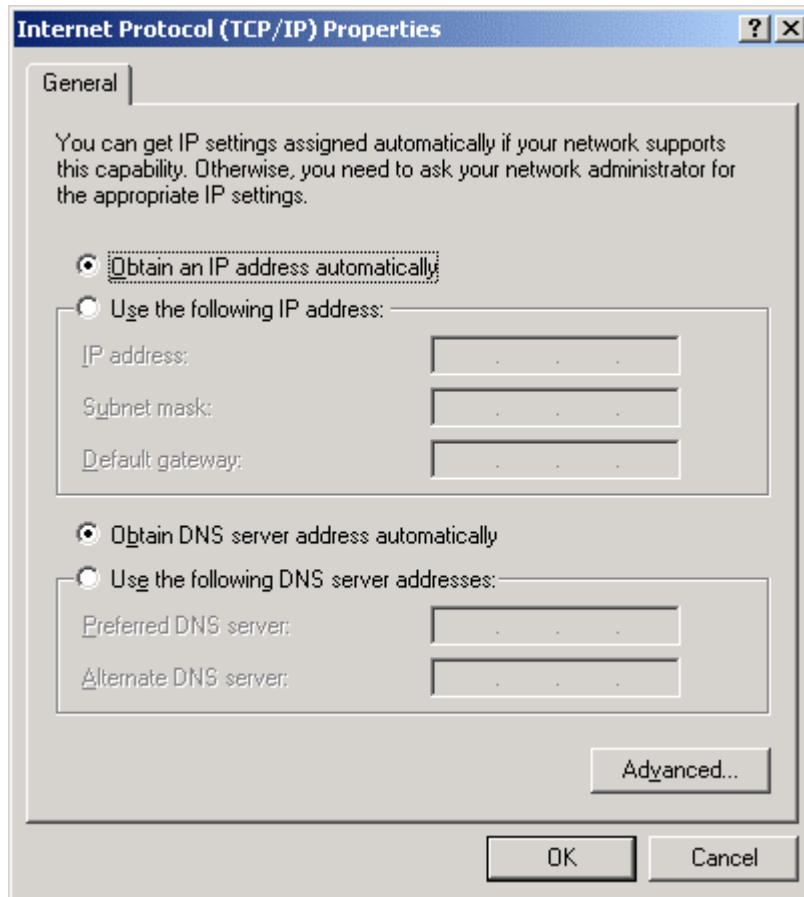


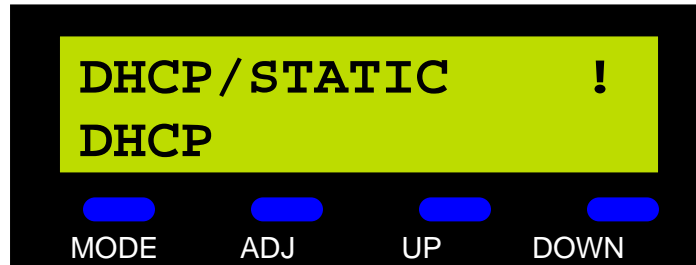
Figure 9 Internet Protocol Properties – DHCP Setup

5. Your PC is now configured for DHCP. Press OK to accept the changes.

Note: You may need to reboot your PC to actually be assigned an IP address.

TCweb Software Setup

The TCweb comes DHCP ready when shipped. It requires no additional setup. You can confirm the DHCP settings by pressing the MODE button 3 times to display the screen below.



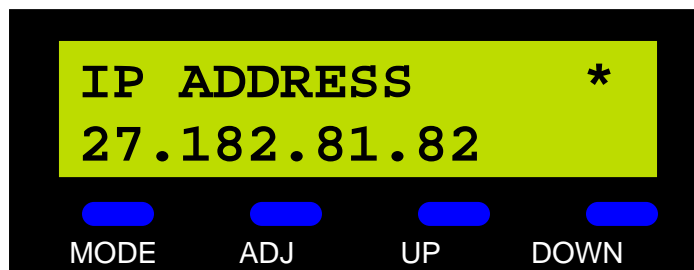
Verify that the bottom line reads DHCP. If the bottom line reads "Static" you will need to set it to DHCP. Press the adjust (ADJ) button once, then press either the UP or DOWN button to toggle to DHCP. Press the ADJ button a second time to accept the new settings. For more information on navigating the TCWeb LCD display screen, see Appendix B TCweb Navigation

Verify DHCP IP Addressing

1. Make sure your PC and the TCweb's are connected to the router.
2. In the following order:
 - a. Cycle the power on the router. (Allow it to boot completely).
 - b. Cycle the power on each TCweb.
 - c. Reboot your PC.

When the PC and the TCweb's reboot, they broadcast a request for IP addresses from a DHCP server. The DHCP server in the cable router will provide unique IP addresses for the PC and each TCweb at this time.

3. To confirm that each TCweb was assigned an IP Address, press the MODE button on the TCweb 4 times. You should see a screen similar to the one below. Verify that the bottom line contains an IP Address.



The number displayed in the IP Address field is the Ethernet address of the TCweb. Use this address when connecting to the TCweb over Ethernet.

Communications

Communicating ASCII commands over TCP/IP

The TCweb Thermocouple Monitoring system includes a telnet server for connection over networks, modems and the Internet. To connect over TCP/IP you can use a communications program such as Tidal Engineering's TCweb SimpleComm, a third party telnet program or a web browser such as Microsoft's Internet Explorer.

TCweb SimpleComm Setup

TCweb SimpleComm is a free communications application from Tidal Engineering that can communicate with TCweb controllers over TCP/IP. This Visual Basic 6.0 application is available from Tidal Engineering, by request, in both executable and source code form.

To set up the TCweb SimpleComm program for TCP/IP, enter the TCweb's IP Address, set the port to 23 and press Connect.

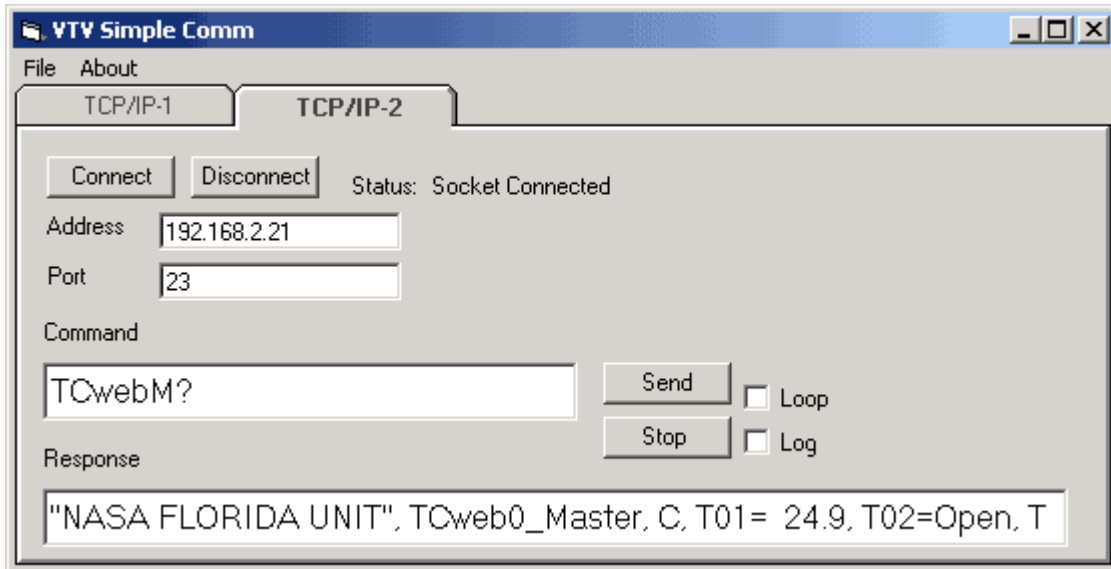


Figure 10 SimpleComm TCP/IP Telnet Connection

When communicating with the TCweb using either SimpleComm or another Telnet program you will want a list of communication commands. This list is available in your TCweb User Manual and, for convenience, as Appendix C at the end of this document.

Microsoft HyperTerminal Setup

This section describes setting up Microsoft HyperTerminal to connect to a TCweb unit over a TCP/IP connection. Other Telnet client programs can also be used and should be setup similarly. See Appendix C for a description of the Telnet commands and their syntax.

The screen shots below were taken on a Windows 2000 workstation. Windows 98, Windows ME and Windows XP have a similar version of HyperTerminal. The HyperTerminal version included with Windows 95 however does not support Telnet TCP/IP Winsock. To setup HyperTerminal to connect to the TCweb follow the instructions below:

1. Go the Windows Start button and select Programs/Accessories/Communications/HyperTerminal. The Connection Description window will appear. Type in a Connection name and click OK.

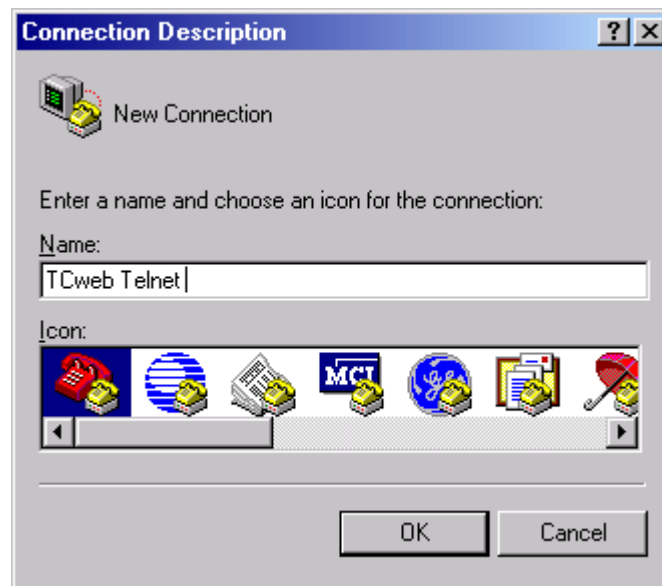


Figure 11 New HyperTerminal Connection

2. The connection Properties window should appear. Drop down the "Connect Using" list and select TCP/IP (Winsock).

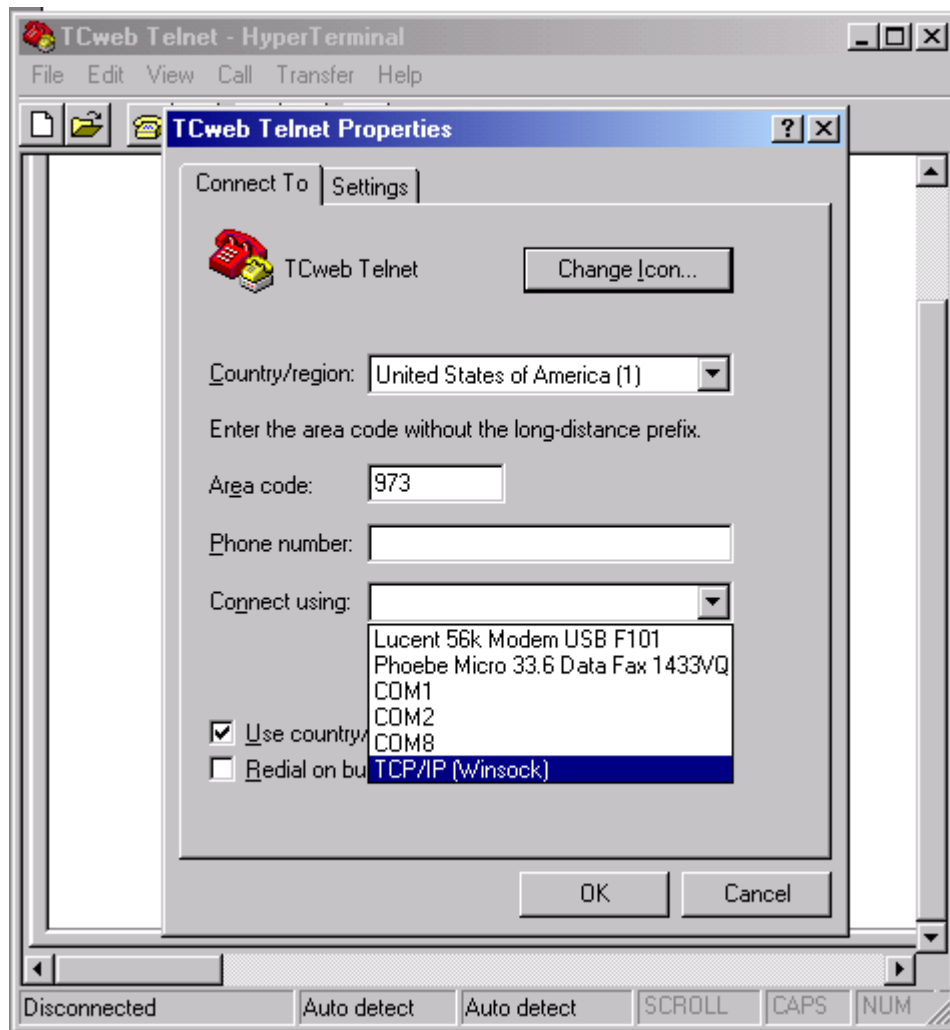


Figure 12 HyperTerminal TCP/IP Settings

3. Type the TCweb's IP address in the Host address text window. For Ethernet connections, the IP address can be obtained from the front of the master TCweb module.

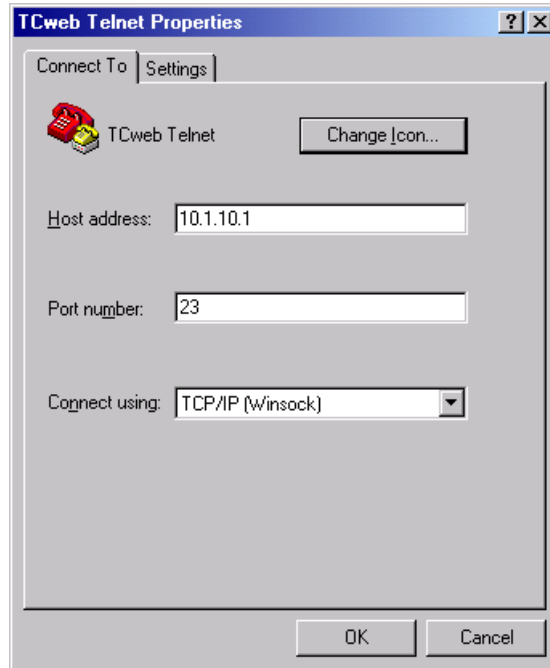


Figure 13 HyperTerminal TCP/IP Settings

4. Press the settings tab and click the "ASCII Setup.." button.

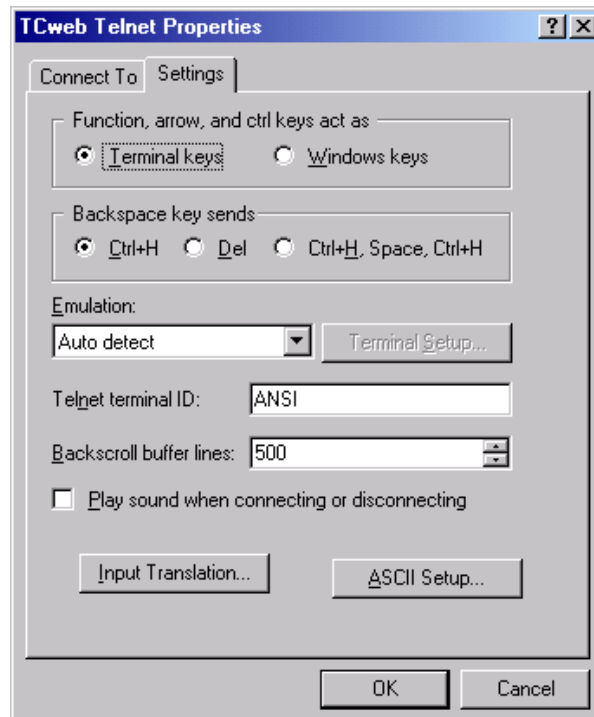


Figure 14 HyperTerminal ASCII Settings

5. The ASCII Setup window will appear. Check the box that says, "Echo typed characters locally" as shown below. Then click OK.

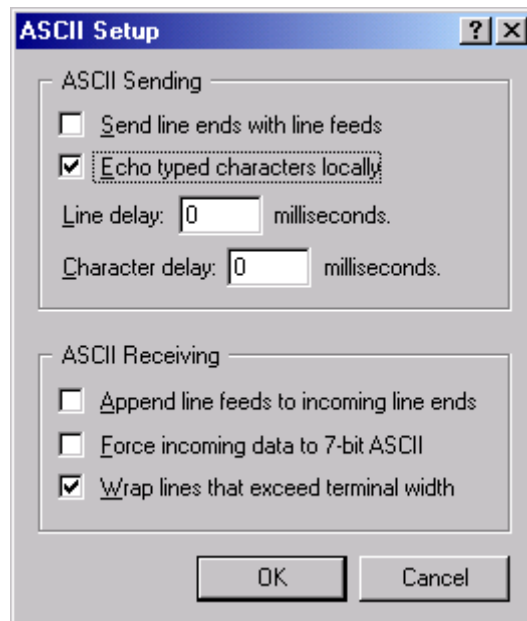


Figure 15 HyperTerminal ASCII Settings

6. Press the Call icon on the toolbar to connect to the TCweb unit (Telephone on hook).

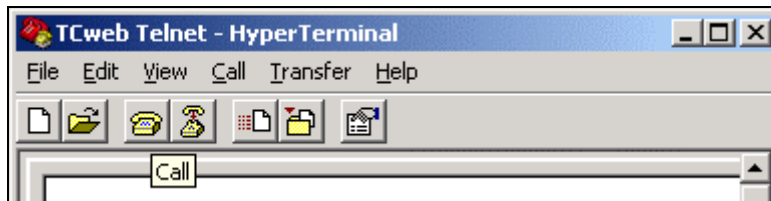


Figure 16 Connecting

7. The TCweb will respond to the connection with the text "TCweb>" as shown below. The status bar at the bottom will say, "Connected hh:mm:ss" where hh:mm:ss is the connection time.

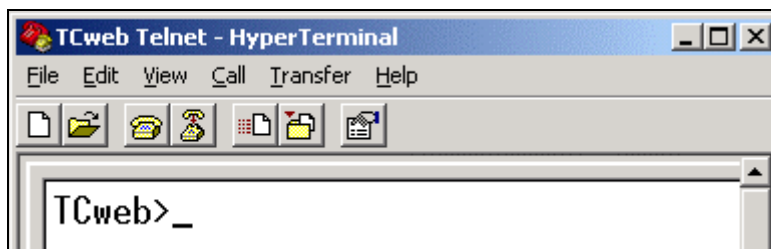


Figure 17 Connected

8. Type "time?" in the text window as shown below and press Enter.

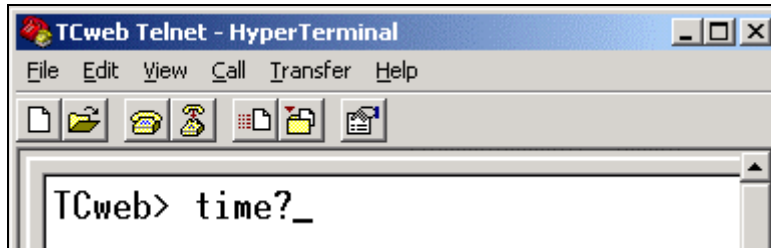


Figure 18 Query

9. The TCweb unit will respond with the current time setting.

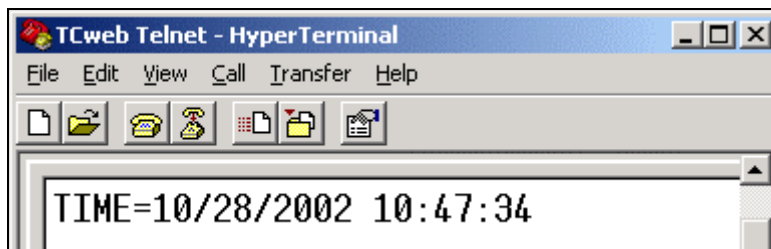


Figure 19 Response

Web Interface

To access the TCweb’s web interface, open a web browser, in the address line type the IP address of the unit. This address is the one assigned by the DHCP server discussed earlier in the Verify DHCP IP Addressing section. There are five screens that constitute the online interface: Main, General Setup, Module Setup, Email/Fax Setup and DAC Setup. You can switch between these screens using the tabs at the top of each TCweb window. For more information on the complete features of the TCweb’s web interface, refer to the user manual. For your browser to interact successfully you will need to set your browser to “check for newer versions of pages every time”. See Appendix D for detailed instructions.

| | Type | Name | Value | Logging |
|----------------------|---------|---------|-------|---------|
| TCweb0_Master | | | | |
| 01 | T | T01 | 25.8 | No |
| 02 | T | T02 | 25.8 | No |
| 03 | T | T03 | 25.8 | No |
| 04 | T | T04 | 25.8 | No |
| 05 | T | T05 | 25.8 | No |
| 06 | T | T06 | 25.8 | No |
| 07 | T | T07 | 25.8 | No |
| 08 | T | T08 | 25.8 | No |
| 09 | T | T09 | 25.8 | No |
| 10 | T | T10 | 25.8 | No |
| 11 | T | T11 | 25.8 | No |
| 12 | T | T12 | 25.8 | No |
| 13 | T | T13 | 25.8 | No |
| 14 | T | T14 | 25.8 | No |
| 15 | T | T15 | 25.8 | No |
| 16 | T | T16 | 25.8 | No |
| A | Ambient | Ambient | 28.6 | No |

Figure 20 TCweb Web Interface

Appendix A Router Setup

Belkin Cable/DSL Router Software Configuration

The default factory settings are correct for this application note. The steps below can be used to modify or confirm these settings. If you need more detailed information on any of the cable router features discussed here, refer to Belkin's Cable/DSL Gateway Router manual.

1. Make sure your router is on and is connected to the PC via an Ethernet cable.
2. Cycle the power to your PC. This action forces the PC to accept the new DHCP assigned IP address. Wait for the PC to finish rebooting.
3. The routers setup program is accessed using Microsoft's Internet Explorer. Open Internet Explorer and type the routers default IP address "192.168.2.1" in the address bar.

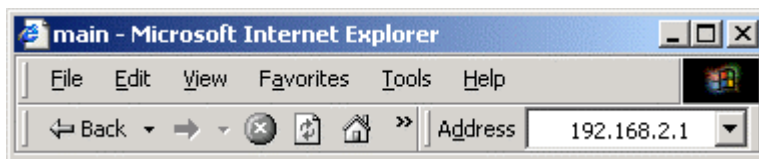


Figure 21 Internet Explorer with Router's Default IP Address

4. Type the routers default User Name "Admin", leave the Password field empty and press OK.

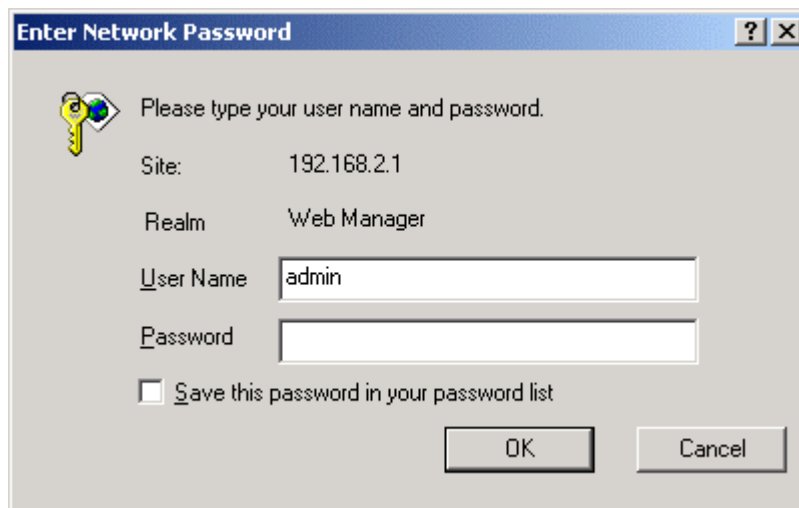


Figure 22 Router User Name

5. Confirm that the values match the screen below, in particular: IP Address, Subnet Mask and DHCP Server. The section that says "Cable/DSL : Disconnected" indicates that our router is not hooked up to an outside cable or DSL line. We are using it simply as a DHCP router.

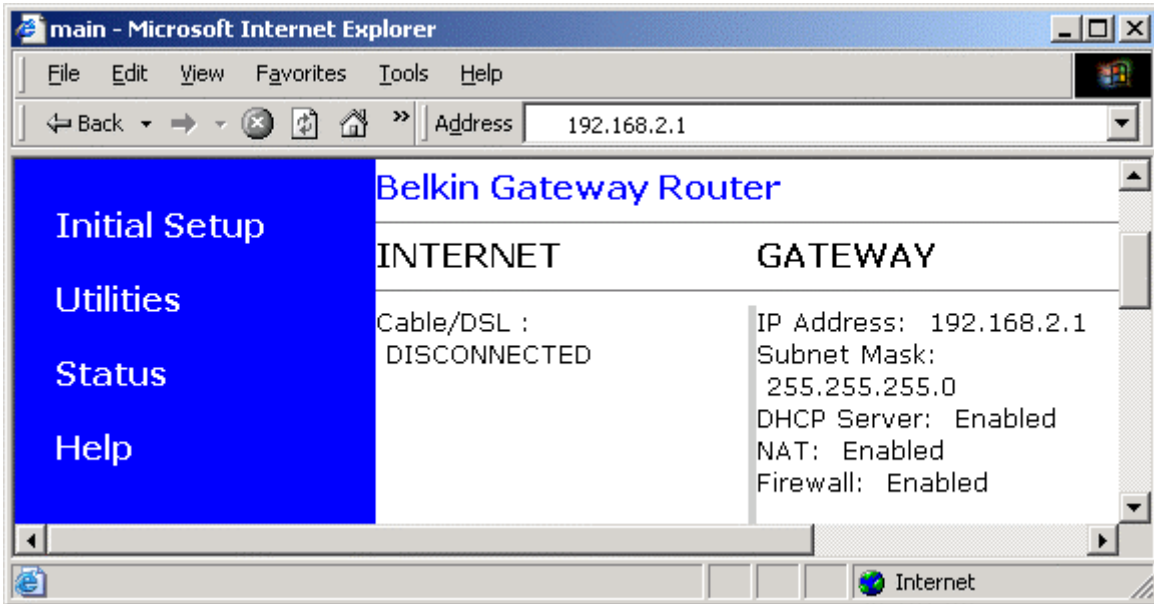


Figure 23 Router Configuration Welcome Screen

6. Select Initial Setup from the navigation menu on the left. Confirm that the option button labeled Dynamic IP Address is selected.

Initial Setup
Your Belkin Gateway Router has the ability to connect to virtually any Broadband connection type. Select the type of connection you have. Knowing your connection type and information about your connection type may require that you contact your Internet Service Provider (ISP).

Select Connection Type

| Type | Usage |
|---|--|
| <input checked="" type="radio"/> Dynamic IP Address | Does your Internet Service Provider (ISP) use Dynamic IP addressing? If you are using a cable modem and are not sure, try selecting Dynamic. If your connection does not work, your ISP may be using Static IP addressing. |

Figure 24 Router Initial Setup Screen

7. Select LAN Services from the navigation menu on the left. Confirm the settings below match the settings on your router.

LAN DHCP Settings

With the Belkin Gateway Router, you can specify an internal IP address. You may also turn the DHCP service on and off. We recommend using DHCP service for the easiest setup of your network. Making changes to this screen will require you to re-configure your networked PC's.

IP address : . . .

IP Subnet Mask : 255.255.255.0

DHCP Service : Enabled Disabled

Lease Time (sec) : ▾

IP address pool

Start IP : . . .

End IP : . . .

Figure 25 Router LAN DHCP Settings Screen

Appendix B TCweb Navigation

Overview

The TCweb has four buttons: MODE, ADJ (Adjust), UP, and DOWN. These buttons are used in conjunction with the Liquid Crystal Display to set the TCweb's display parameters and the IP parameters. The following table is an overview of the functions of each button in the different modes:

| Button | Menu Mode | | Scan Mode |
|-------------|-------------------------|---|--|
| | View Menu | Edit Menu | |
| Mode | Advance to next menu | Advance to next field | Enter Menu Mode |
| Adjust | Enters Edit Menu | Save Menu setting | Display Sensor Name |
| Mode & Up | Returns to Scan Mode | Cancel Edit Menu & Return to View Menu | Switch display to next unit |
| Mode & Down | | | Switch display to previous unit |
| Up | Advance to next menu | Increment value or switch to next selection | Advance to next sensor. Briefly display a sensor name. |
| Down | Return to previous menu | Decrement value or switch to next selection | Advance to previous sensor. Briefly display a sensor name. |

A few general guidelines: ADJ, when in a parameter display screen, toggles between editing and viewing. That is, to edit a value displayed on the screen, press the ADJ button. Then, when you have finished editing the value, hit ADJ again to save the value. The MODE button cycles through the different menus, and when you are editing, acts as a "cancel" button that will exit the edit mode and restore the former value, disregarding changes you made while editing. UP and DOWN will cycle through values while editing, and shift the part of the menu displayed in the screen for large menus. The asterisk displayed in the top right of the screen indicates that the value is Read-Only and can't be manually changed, as in a DHCP assigned IP address. The exclamation point indicates that the value can be changed manually. And finally, the question mark means that the value is currently being edited. When a value is being edited, it will either be in parenthesis or blink.

Appendix C Telnet Syntax

| Command Syntax | Description | Comments |
|----------------|---|---|
| TCWEBMxx? | Here, xx is the two digit number of the unit you are querying: 00 for the master, 01 for the first slave, and so on up to 15 for the fifteenth slave. | Response: UNITNAME, TCWEBM01, C, T01=13.1, T02=8.1, ... , K16=-23.1, Amb=25.2 |
| TCWEBM? | This command is the same as the previous one, but it works only for the master | |
| QUIT | Breaks the connection with the TCweb | |
| \r | Returns the version number | |
| TIME= | TIME=mm/dd/yyyy hh:mm:ss | Example: TIME=10/07/2002 10:59:04 |
| TIME? | Query TCweb Real Time Clock | Typical Response: TIME=10/07/2002 10:59:04 |

Appendix D - Configuring Internet Explorer

The web server works seamlessly with Microsoft Internet Explorer version 5.0 and higher. You must, however, adjust the default settings in Internet Explorer. Open Internet Explorer and from the Tools menu, select Internet Options.

1. Click the Settings button under Temporary Internet Files.

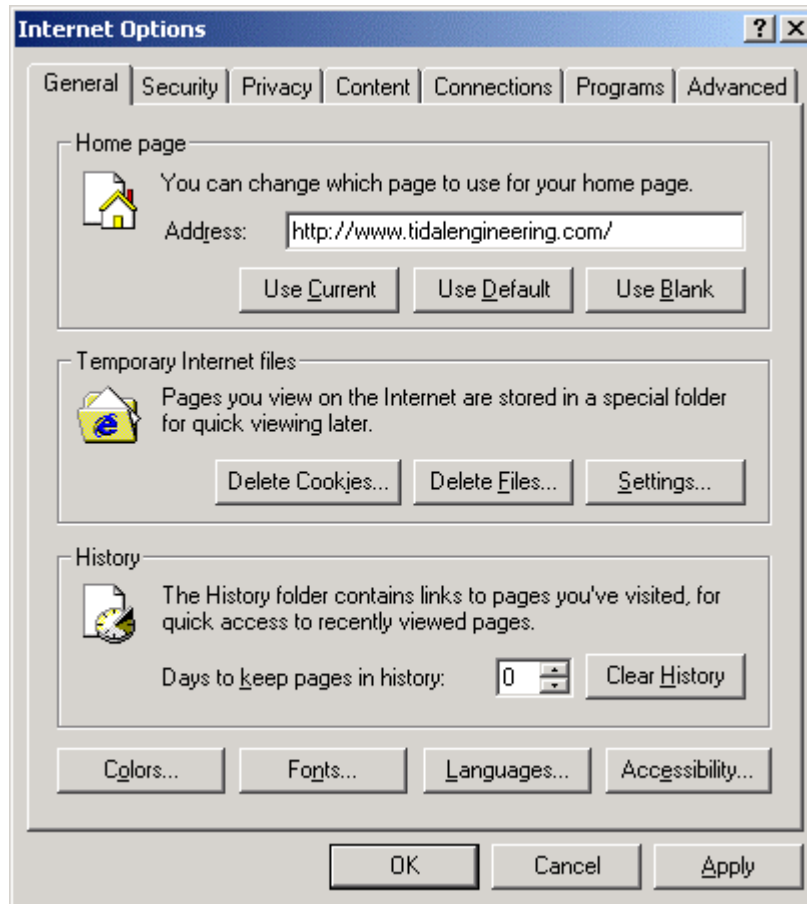


Figure 26 Internet Explorer's Internet Options

2. In the Settings screen, select the "Every visit to the page" option. Press OK to save the configuration.

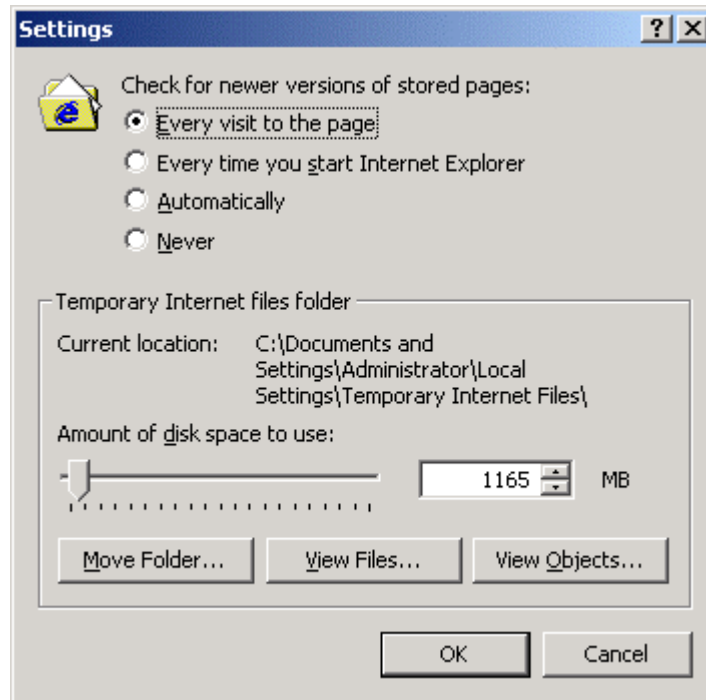


Figure 27 Internet Explorer's Temporary Files Settings

Caution: The TCweb may work unpredictably if this setting is not changed.

Appendix E Trouble Shooting

Troubleshooting

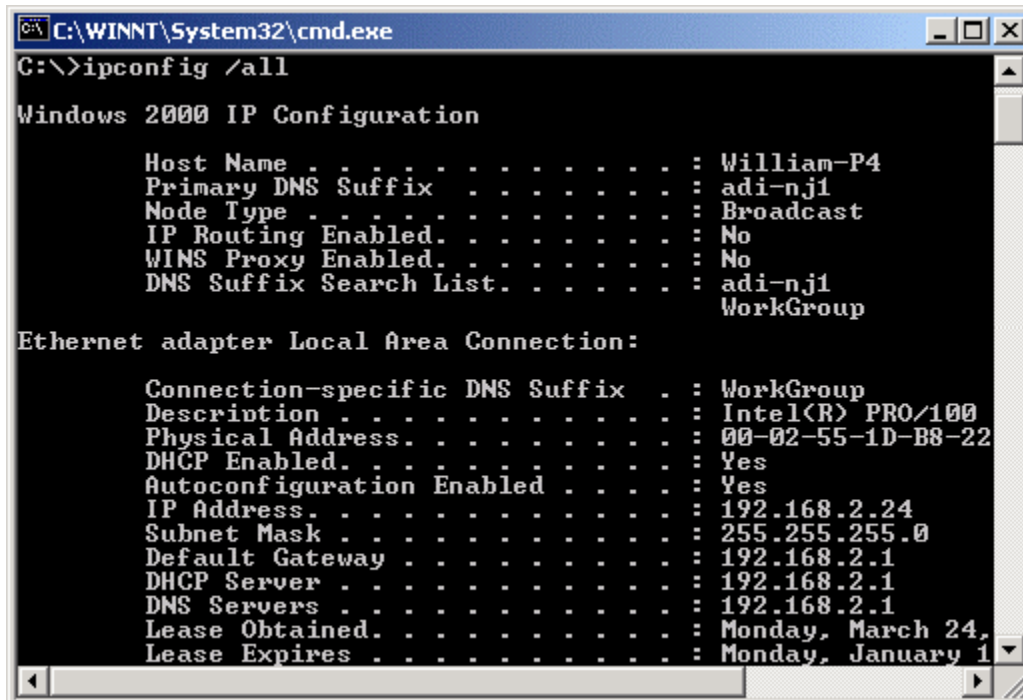
If you cannot communicate with the TCweb using telnet or Internet Explorer through the router please review the instructions in this manual:

- confirm the PC settings.
- confirm the Belkin Cable/DSL Router settings.
- confirm the TCweb settings.

The problem may be that either the PC or the TCweb did not get assigned an address by the DHCP router. Cycle the power first on the router. After it reboots, cycle the power on the TCweb and on your PC. Return to the "TCweb Software Setup" section and confirm that the IP Address field of the TCweb is displaying an IP Address. If it is, then the VTV and the Router are communicating properly.

To check the communications between the PC and the router, press the Start button on your PC desktop, select Run, type "cmd" and press enter. From the DOS window type "ipconfig" and hit [Enter].

The information displayed under the Local Area Connection applies to this application. If this information isn't displayed correctly, then the communication between the PC and the router incorrect. Review the PC setup instruction section and refer to the Belkin Cable/DSL Gateway Router User Manual. The IP Address refers to the IP Address of your PC. The DHCP Server address refers to the address of the Belkin router.



```
C:\WINNT\System32\cmd.exe
C:\>ipconfig /all

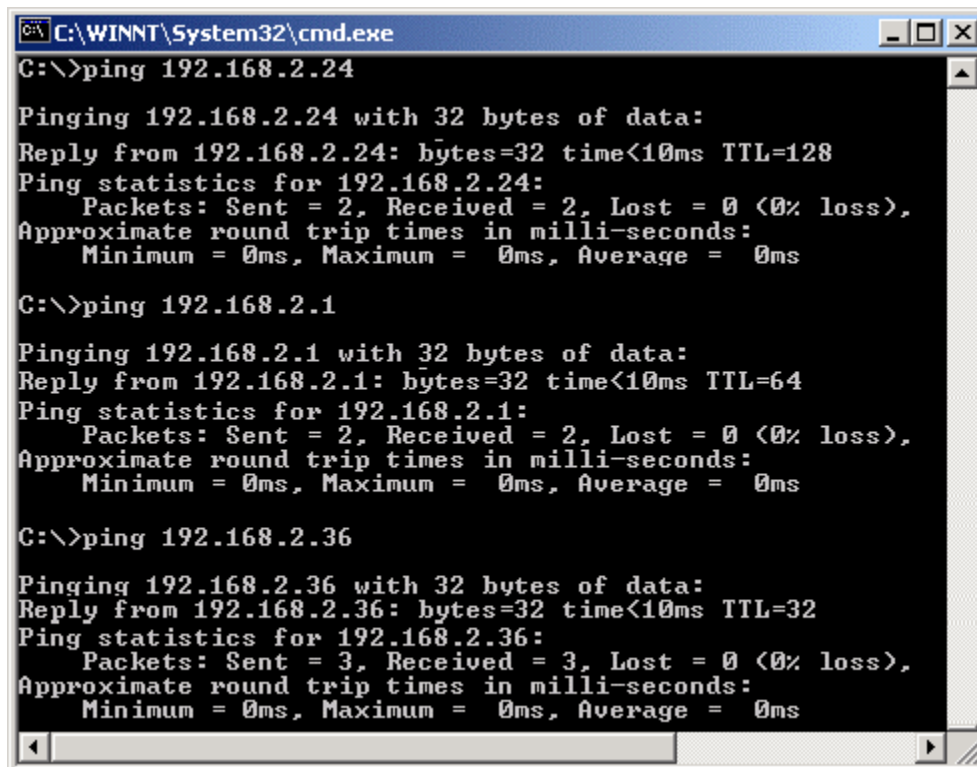
Windows 2000 IP Configuration

    Host Name . . . . . : William-P4
    Primary DNS Suffix . . . . . : adi-njl
    Node Type . . . . . : Broadcast
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List . . . . . : adi-njl
                                        WorkGroup

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : WorkGroup
    Description . . . . . : Intel(R) PRO/100
    Physical Address. . . . . : 00-02-55-1D-B8-22
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 192.168.2.24
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.2.1
    DHCP Server . . . . . : 192.168.2.1
    DNS Servers . . . . . : 192.168.2.1
    Lease Obtained. . . . . : Monday, March 24,
    Lease Expires . . . . . : Monday, January 1
```

Figure 28 Command Prompt Troubleshooting with Ipconfig



```
C:\WINNT\System32\cmd.exe
C:\>ping 192.168.2.24

Pinging 192.168.2.24 with 32 bytes of data:
Reply from 192.168.2.24: bytes=32 time<10ms TTL=128
Ping statistics for 192.168.2.24:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.2.1

Pinging 192.168.2.1 with 32 bytes of data:
Reply from 192.168.2.1: bytes=32 time<10ms TTL=64
Ping statistics for 192.168.2.1:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.2.36

Pinging 192.168.2.36 with 32 bytes of data:
Reply from 192.168.2.36: bytes=32 time<10ms TTL=32
Ping statistics for 192.168.2.36:
    Packets: Sent = 3, Received = 3, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Figure 29 Command Prompt Troubleshooting with Ping

If the ipconfig response is OK then try pinging your PC, the router and the VTV from the command widow.

To test the PC connection, type “ping” and the IP address of your PC (ex. ping 192.168.2.24). You can find the IP address of your PC in the previous section.

To test the router connection, type “ping” then the IP Address of the router (ex. ping 192.168.2.1). If the ping is successful then the communications between the PC and the router are OK.

To test the TCweb connection, type “ping” and then the IP Address of the TCweb (ex. ping 192.168.2.36). You can find the IP Address of the TCweb by reviewing the TCweb Software Setup section. If the ping is successful then the PC is successfully communicating with the TCweb.

If this doesn't fix the problem, consult your network administrator, one or more addresses may be conflicting with computers already on the network.

About Tidal Engineering

Headquartered in Randolph, NJ, Tidal Engineering Corporation has been designing and building award-winning embedded hardware and software for test and measurement and data acquisition applications since 1992. The company further provides product development services together with engineering support, and is recognized for technical expertise in such areas as Embedded IEEE 488, and turnkey SCADA (Supervisory Control and Data Acquisition) systems. Tidal's products are available exclusively through ADI American Distributors Inc., an ISO-9002 certified distributor of electronic and electromechanical components and assemblies.

Tidal Engineering Corporation
2 Emery Avenue
Randolph, NJ 07869
Tel: 973/328-1181
Fax: 973/328-2302
www.TidalEng.com
info@tidaleng.com