

ADNP/ESC1 μ Clinux Starter Kit: First Steps

The DIL/NetPC ADNP/ESC1 starter kit contains everything you need to get started with your Altera NIOS-based embedded networking application. The starter kit includes a ADNP/ESC1 module with a pre-installed embedded Linux (uClinux), the evaluation board DNP/EVA7, power supply, serial interface (null modem) cable, a CD-ROM with software and documentation and a printed user manual for the first steps with the starter kit.

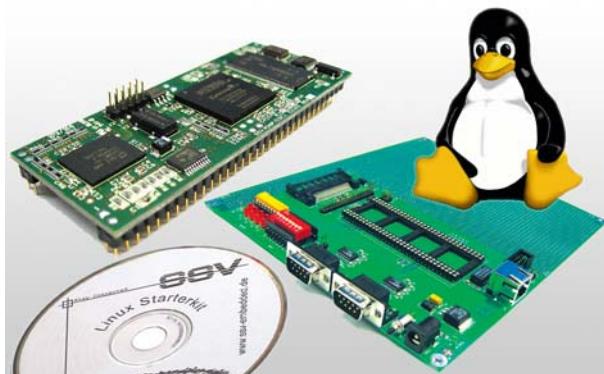


Figure 1: The DIL/NetPC ADNP/ESC1 μ Clinux Starter Kit

The starter kit CD-ROM comes with a full GNU cross tool chain for C/C++ software development. This binary files of this tool chain runs on a x86 Linux-based host (SuSE, Red Hat or other) and builds *bFLT* (uClinux Binary Flat Format) binary files for the Altera NIOS 32-bit soft core microcontroller.

For using the DIL/NetPC ADNP/ESC1 Embedded Linux Starter Kit you need a development system. The minimal configuration for this system is a Windows-based PC with the HyperTerminal terminal emulation program and a free COM port (COM1, COM2 or USB-based COMx) for the RS232 serial link between the DIL/NetPC ADNP/ESC1 and HyperTerminal.

For using the Ethernet link, your PC needs an Ethernet adapter with 10 Mbps or 10/100 Mbps LAN interface. This environment allows web server programming (HTML pages, Java Applets) and Linux shell script programming. For using the GNU C/C++ cross tool chain, it is necessary to run Linux on the development system.

The ADNP/ESC1 Embedded Linux Starter Kit Key Features

The DIL/NetPC ADNP/ESC1 pre-installed embedded Linux consists of two main components: 1. the Linux kernel and 2. the root file system. The ADNP/ESC1 Flash also offers a Flash Loader for downloading new versions of the Linux kernel and the root file system. This in-system programming feature can be used by a simple serial and Ethernet link between the development system and the ADNP/ESC1.

- DIL/NETPC ADNP/ESC1 with 50 MHz Altera NIOS RISC Softcore, 16 Mbytes SDRAM, 8 Mbytes Flash and 10/100 Mbps Ethernet
- Firmware and Embedded Linux pre-installed in Flash memory
- Evaluation Board DNP/EVA7 with a pre-installed CompactFlash card
- Null modem Cable
- 110 VAC or 230 VAC to 5 VDC International Power Supply
- CD-ROM with User Manual and Hardware/Programmers Manuals
- Embedded Linux with Source
- GNU Cross Tool Chain for C/C++ Software Development for Linux-based PCs
- *elf2flt* Converter Program (NIOS ELF to uClinux bFLT)
- NIOS ELF GNU *gdb* for RS232-based Remote Debugging
- Linux Remote Login with Telnet
- Web Server Setup Sample
- Embedded FTP Server for Ethernet-based up- and downloads
- Many Sourcecode Samples

1. Step: Cable for the Serial Link between the ADNP/ESC1 and a PC

Set-up the serial link between the DIL/NetPC ADNP/ESC1 Evaluation Board and your PC. Use a Null modem cable for this connection.

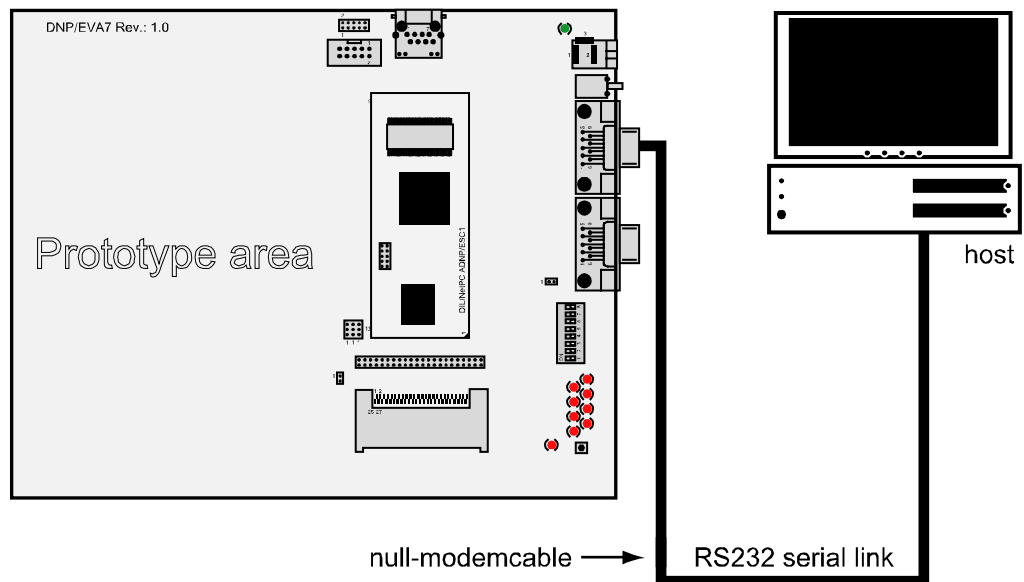


Figure 2: Serial Link between the DIL/NetPC Evaluation Board and the PC

Connect one end of the Null modem cable with a unused COM port of your PC. Make sure, that this PC COM port supports 115.200 bps.

2. Step: Cable for the Ethernet Link between the ADNP/ESC1 and a PC

Set-up the Ethernet LAN link between the DIL/NetPC ADNP/ESC1 Evaluation Board and your PC. Use an Ethernet Cross-over cable for the first LAN connection.

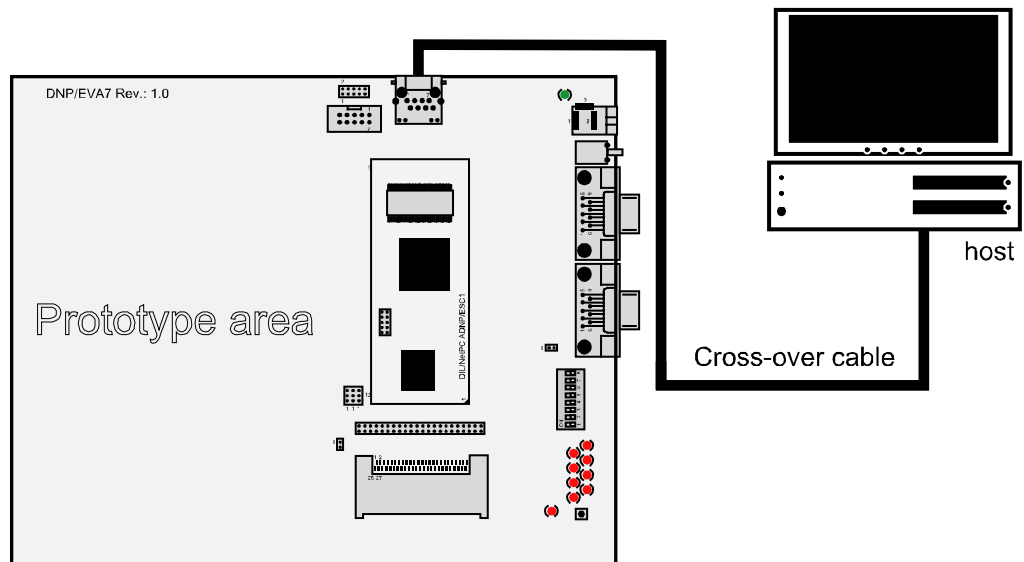


Figure 3: Ethernet Link between the DIL/NetPC Evaluation Board and the PC

Please note: The ADNP/ESC1 comes with a pre-installed DHCP client program. This client runs at boot time and try out to get a IP address from a DHCP server. Please make sure that the ADNP/ESC1 can find a DHCP server within your LAN and that this server supply's valid IP addresses for new LAN members.

3. Step: Connect the Power Supply and Power-up the Starter Kit

Connect a 5 VDC power supply to DIL/NetPC Evaluation Board. Make sure, that the + voltage is within the center of power supply connector.

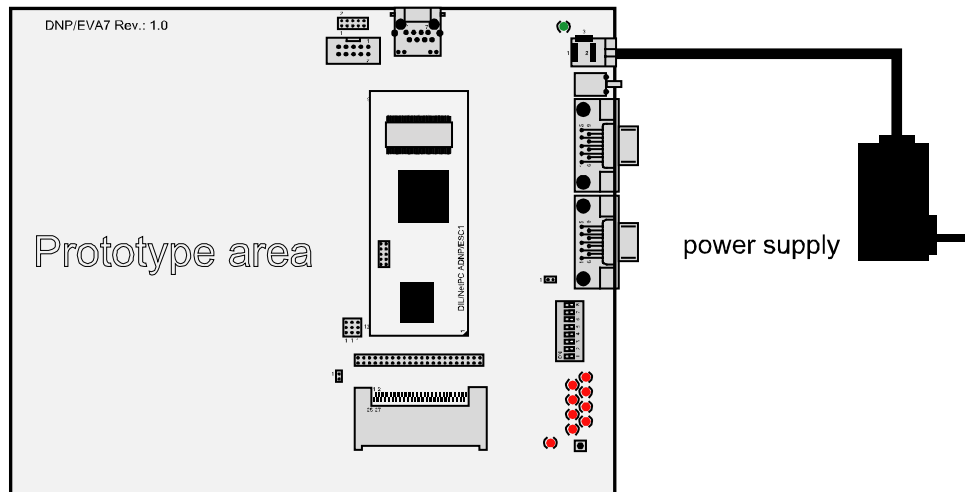


Figure 4: Power Supply for the DIL/NetPC Evaluation Board

Please note: Make sure, that all cable connections are OK. Then power-up the starter kit.

4. Step: Using the Serial Link with a Terminal Program

Run *HyperTerminal* on your Windows-PC, *minicom* or a similar simple terminal emulation program on your Linux-based PC.



Figure 5: Direct Connection Set-up with *HyperTerminal*

Set-up a direct connection with the parameters of Table 1. Make sure, that the PC COM port supports 115.200 bps.

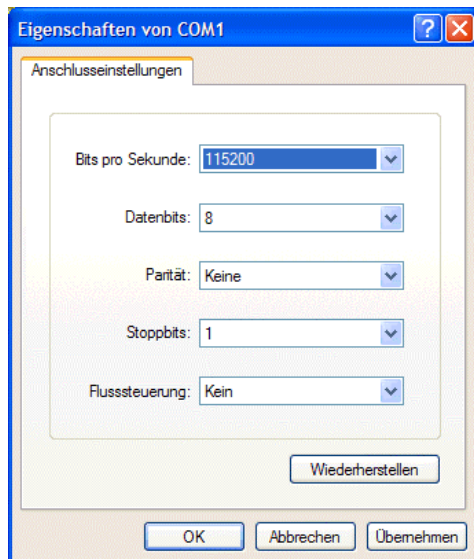


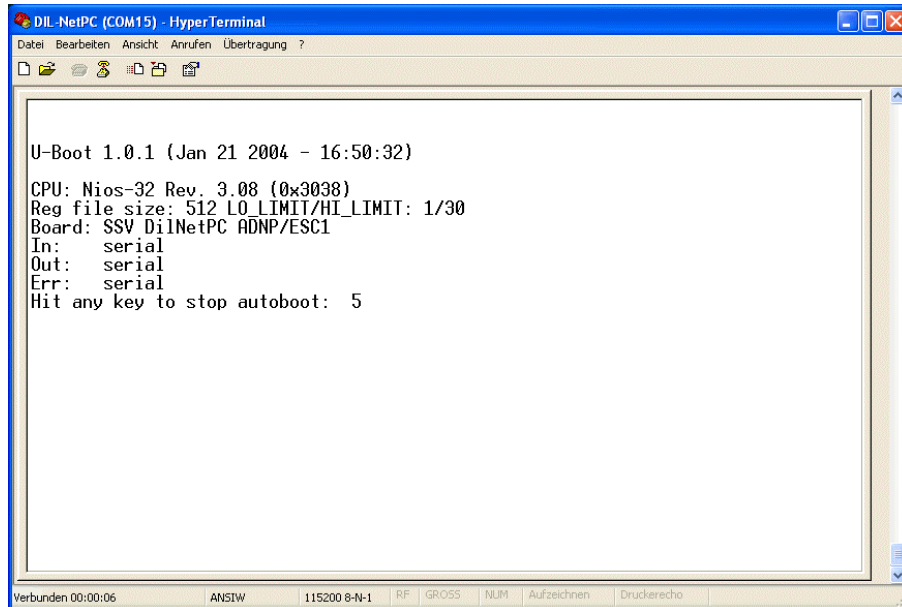
Figure 6: Parameter Set-up with *HyperTerminal*

Parameter	Value
Speed	115.200 bps
Data Bits	8
Parity	Keine
Stop Bits	1
Protocol	No (Xon/Xoff, RTS/CTS or similar)

Table 1: Set-up Parameters for the Serial Link

5. Step: Power-up the ADNP/ESC1 without RCM Jumper

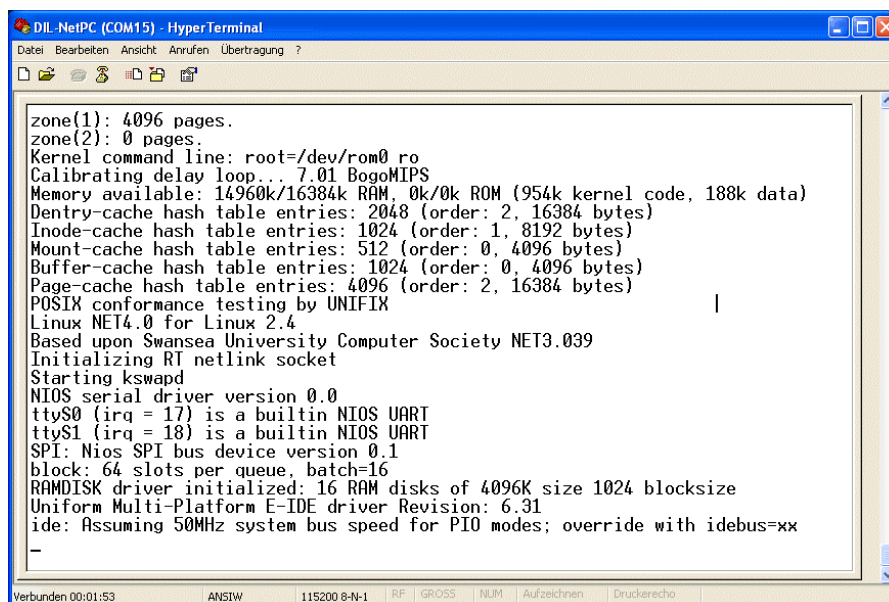
Without the RCM jumper, the DIL/NetPC ADNP/ESC1 is booting μ Clinux from Flash memory within some seconds. The first messages comes from the U-BOOT boot loader.



```
DIL-NetPC (COM15) - HyperTerminal
Datei Bearbeiten Ansicht Anrufen Übertragung ?
U-Boot 1.0.1 (Jan 21 2004 - 16:50:32)
CPU: Nios-32 Rev. 3.08 (0x3038)
Reg file size: 512 LO_LIMIT/HI_LIMIT: 1/30
Board: SSV_DilNetPC ADNP/ESC1
In: serial
Out: serial
Err: serial
Hit any key to stop autoboot: 5
Verbinden 00:00:06 ANSIW 115200 8-N-1 RF GROSS NUM Aufzeichnen Druckerscho
```

Figure 7a: Watch the U-BOOT boot loader with *HyperTerminal*

The terminal emulation program offers a serial console to the ADNP/ESC1 μ Clinux. You can enter and execute μ Clinux commands with the terminal emulation program after the boot process finish's.

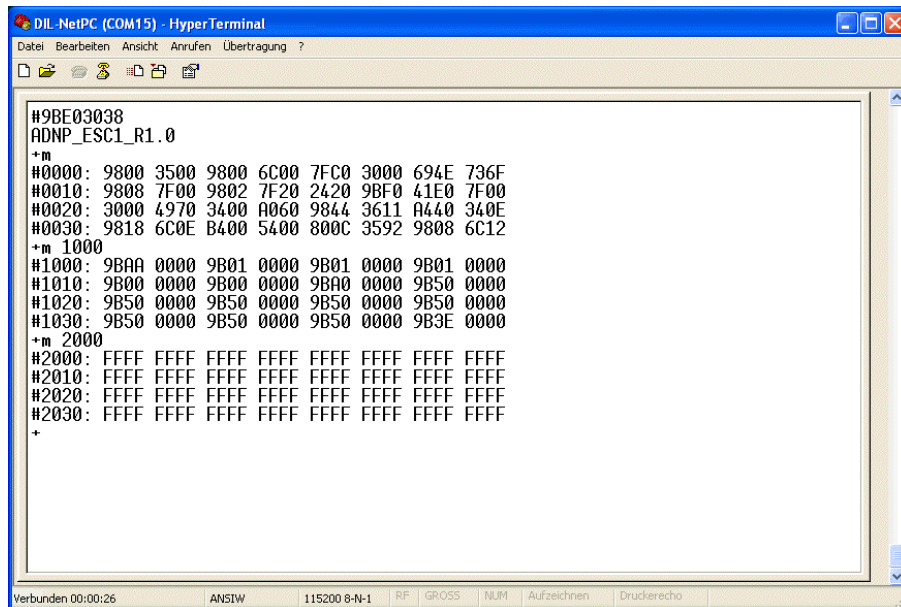


```
DIL-NetPC (COM15) - HyperTerminal
Datei Bearbeiten Ansicht Anrufen Übertragung ?
zone(1): 4096 pages.
zone(2): 0 pages.
Kernel command line: root=/dev/rom0 ro
Calibrating delay loop... 7.01 BogoMIPS
Memory available: 14960k/16384k RAM, 0k/0k ROM (954k kernel code, 188k data)
Dentry-cache hash table entries: 2048 (order: 2, 16384 bytes)
Inode-cache hash table entries: 1024 (order: 1, 8192 bytes)
Mount-cache hash table entries: 512 (order: 0, 4096 bytes)
Buffer-cache hash table entries: 1024 (order: 0, 4096 bytes)
Page-cache hash table entries: 4096 (order: 2, 16384 bytes)
POSIX conformance testing by UNIFIX
Linux NET4.0 for Linux 2.4
Based upon Swansea University Computer Society NET3.039
Initializing RT netlink socket
Starting kswapd
NIOs serial driver version 0.0
ttyS0 (irq = 17) is a builtin NIOs UART
ttyS1 (irq = 18) is a builtin NIOs UART
SPI: Nios SPI bus device version 0.1
block: 64 slots per queue, batch=16
RAMDISK driver initialized: 16 RAM disks of 4096K size 1024 blocksize
Uniform Multi-Platform E-IDE driver Revision: 6.31
ide: Assuming 50MHz system bus speed for PIO modes; override with idebus=xx
-
Verbinden 00:01:53 ANSIW 115200 8-N-1 RF GROSS NUM Aufzeichnen Druckerscho
```

Figure 7b: Watch the μ Clinux booting process with *HyperTerminal*

6. Step: Power-up the ADNP/ESC1 with RCM Jumper

With the RCM jumper, the DIL/NetPC ADNP/ESC1 runs the default flash loader program *GERMS* direct after power-up from a NIOS ROM memory space.



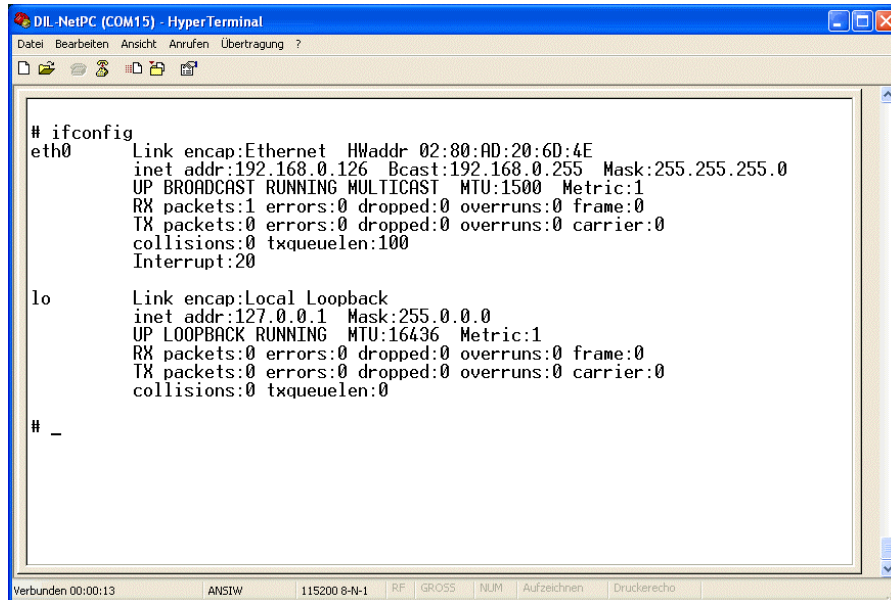
```
#9BE03038
ADNP_ESC1_R1.0
+m
#0000: 9800 3500 9800 6C00 7FC0 3000 694E 736F
#0010: 9808 7F00 9802 7F20 2420 9BF0 41E0 7F00
#0020: 3000 4970 3400 A060 9844 3611 A440 340E
#0030: 9818 6C0E B400 5400 800C 3592 9808 6C12
+m 1000
#1000: 9BAA 0000 9B01 0000 9B01 0000 9B01 0000
#1010: 9B00 0000 9B00 0000 9B00 0000 9B50 0000
#1020: 9B50 0000 9B50 0000 9B50 0000 9B50 0000
#1030: 9B50 0000 9B50 0000 9B50 0000 9B3E 0000
+m 2000
#2000: FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF
#2010: FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF
#2020: FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF
#2030: FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF
+
```

Figure 8: Using *GERMS* with *HyperTerminal*

The monitor program *GERMS* needs a special setup of your terminal program. It is necessary, that the terminal program adds a LF (Line Feed) direct after each CR (Carriage Return). *HyperTerminal* offers a special ASCII configuration for this mode.

7. Step: Check the IP Address of your PC

Make sure that your PC is using the right IP address for the Ethernet-based TCP/IP communication with the DIL/NetPC. Use 192.168.0.1 or 192.168.0.254 for your PC and 192.168.0.126 for the ADNP/ESC1.



```

DIL-NetPC (COM15) - HyperTerminal
Datei Bearbeiten Ansicht Anrufen Übertragung ?
# ifconfig
eth0    Link encap:Ethernet HWaddr 02:80:AD:20:6D:4E
        inet addr:192.168.0.126 Bcast:192.168.0.255 Mask:255.255.255.0
        UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
        RX packets:1 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:100
        Interrupt:20

lo      Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0
        UP LOOPBACK RUNNING MTU:16436 Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0

# _
Verbunden 00:00:13      ANSIW      115200 8-N-1      RF      GROSS      NUM      Aufzeichnen      Druckerecho

```

Figure 9a: Check the ADNP/ESC1 IP address with *ifconfig*

Talk to your network administrator if you have problems with the IP address understanding.



```

Eingabeaufforderung
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Dokumente und Einstellungen\kdw>ipconfig

Windows-IP-Konfiguration

Ethernetadapter LAN-Verbindung:

    Verbindungsspezifisches DNS-Suffix:
    IP-Adresse . . . . . : 192.168.0.254
    Subnetzmaske . . . . . : 255.255.255.0
    Standardgateway . . . . . :

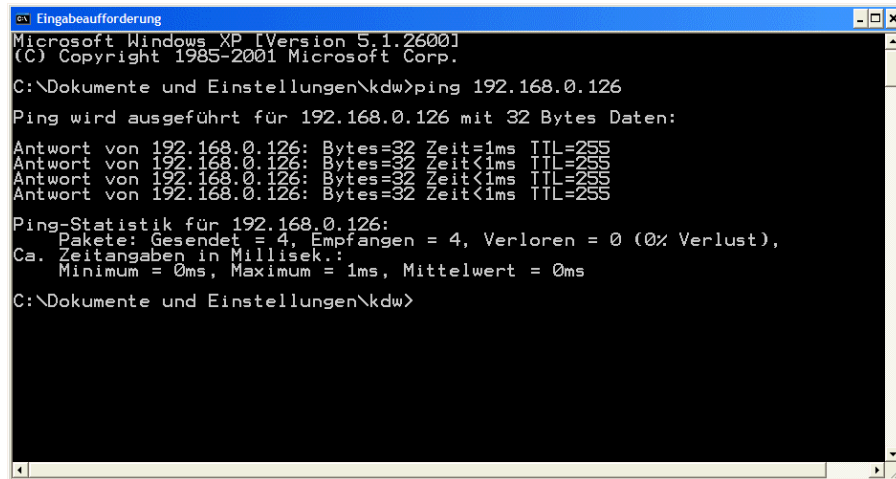
C:\Dokumente und Einstellungen\kdw>

```

Figure 9b: Windows-PC IP address check with *ipconfig*

8. Step: Check the Ethernet-based TCP/IP Communication

Check the Ethernet-based TCP/IP communication between the ADNP/ESC1 and the PC with a simple *ping* command.



```
Eingabeaufforderung
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Dokumente und Einstellungen\kdw>ping 192.168.0.126
Ping wird ausgeführt für 192.168.0.126 mit 32 Bytes Daten:
Antwort von 192.168.0.126: Bytes=32 Zeit=1ms TTL=255
Antwort von 192.168.0.126: Bytes=32 Zeit<1ms TTL=255
Antwort von 192.168.0.126: Bytes=32 Zeit<1ms TTL=255
Antwort von 192.168.0.126: Bytes=32 Zeit<1ms TTL=255
Ping-Statistik für 192.168.0.126:
    Pakete: Gesendet = 4, Empfangen = 4, Verloren = 0 (0% Verlust),
    Ca. Zeitangaben in Millisek.:
        Minimum = 0ms, Maximum = 1ms, Mittelwert = 0ms
C:\Dokumente und Einstellungen\kdw>
```

Figure 10: Windows-PC TCP/IP communication check with *ping*

First check the cable connections and then the IP addresses if your *ping* doesn't work.

9. Step: Check the ADNP/ESC1 Embedded Web server

Run a Web browser program. Enter the URL `http://192.168.0.126` for access the ADNP/ESC1 Web pages.

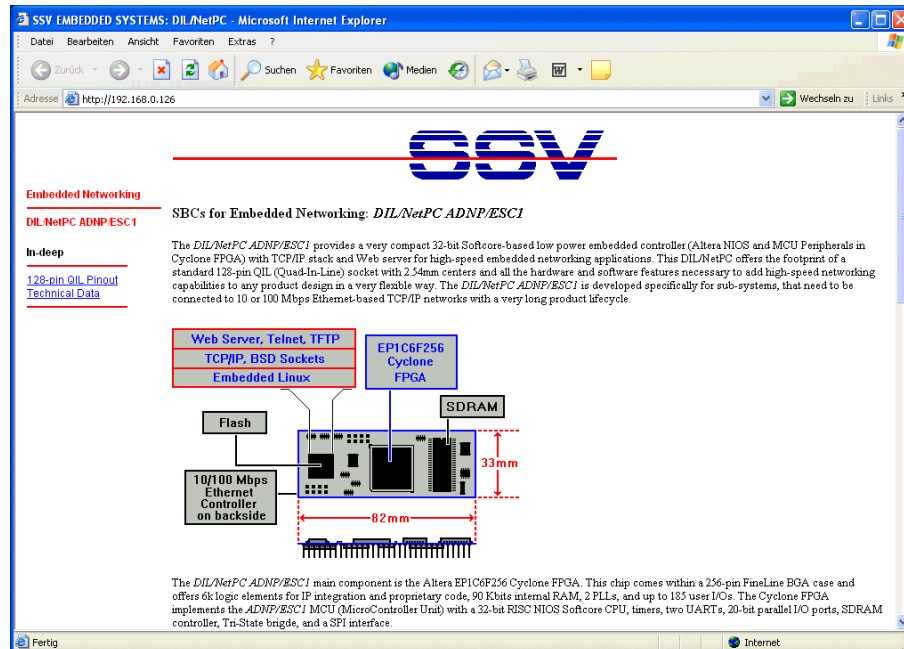


Figure 11: Check the Embedded Webserver with *Internet Explorer*

Please note: The ADNP/ESC1 default HTML pages and GIF pictures are located at `/home/httpd` of your DNP/EVA7 CompactFlash memory card.

10. Step: Using a Telnet Connection

Run a Telnet client program on your PC with the IP address of the ADNP/ESC1. You can use a Telnet session for remote entering μ Clinux commands.

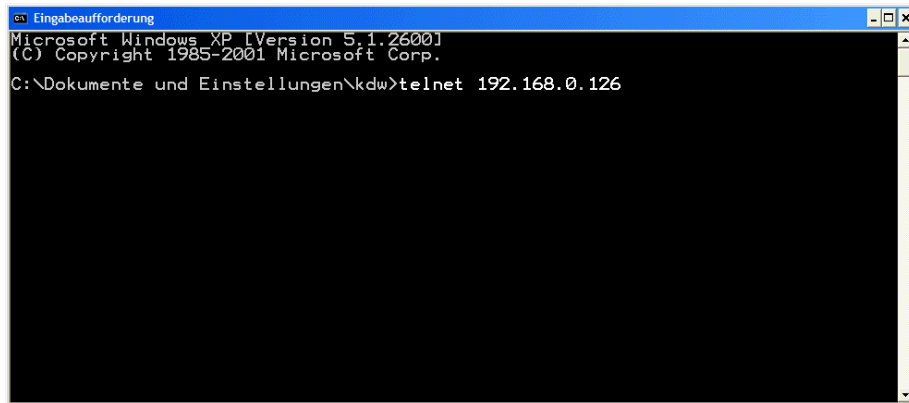


Figure 12: Run the Windows Telnet client program

Please note: The DIL/NetPC ADNP/ESC1 μ Clinux comes with a simple shell. All ADNP/ESC1 μ Clinux command lines commands are implemented in this simple shell. The utilities in simple shell generally have fewer options than their full-featured GNU cousins; however, the options that are included provide the expected functionality and behave very much like their GNU counterparts. The simple shell provides a fairly complete environment for any small or embedded system.

A ADNP/ESC1 Telnet session needs a login. Please use the user name *root* and the password *uClinux* (please use the same small and capital letters).

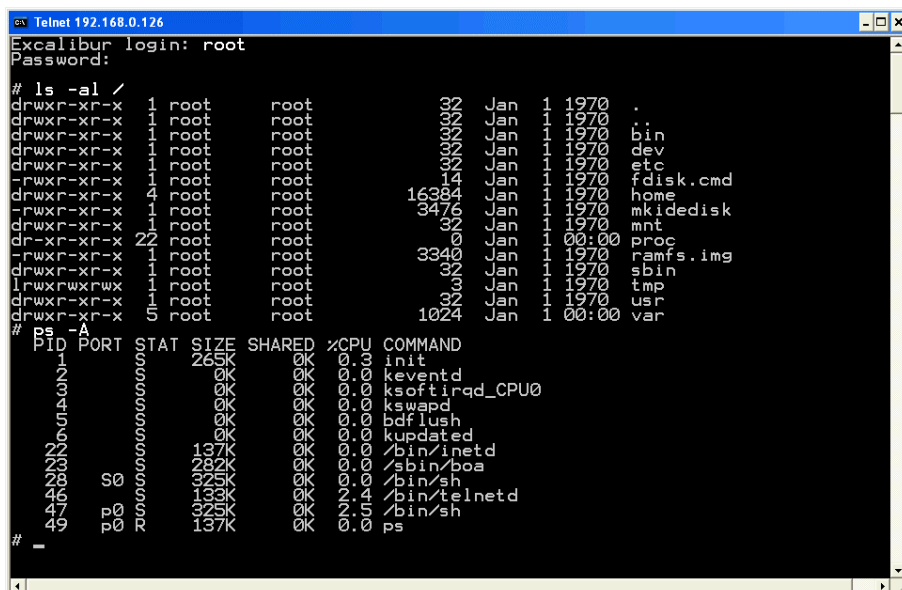


Figure 13: Using μ Clinux commands within a Telnet client window

The DIL/NetPC ADNP/ESC1 µClinux is mounting the CompactFlash memory card of your DNP/EVA7 to the directory `/home`. The directory `/home/httpd` of the memory card offers the content for the ADNP/ESC1 embedded Web server.

Please enter the following HTML lines with the help of your ADNP/ESC1 Telnet session:

```
cd /home/httpd
cat > test.html
<html>
<head>
<title>Hello World!</title>
</head>
<body>
<h1> Hello World!</h1>
</body>
</html>
CTRL-D (Stops the Linux cat command)
```

The DIL/NetPC ADNP/ESC1 µClinux stores your HTML lines in the file `/home/httpd/test.html` of your DNP/EVA7 CompactFlash memory card. Then run a Web browser program. Enter the URL

```
http://192.168.0.126/test.html
```

Change the IP address within this URL if necessary. The Web browser shows the HTML output for `test.html`.

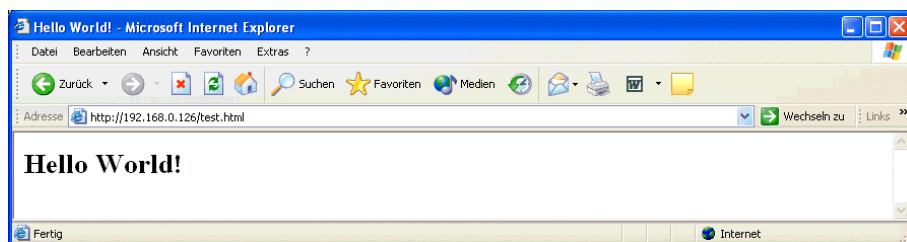


Figure 14: Output of `/home/httpd/test.html`

Helpful Literature

DNP/EVA7 Hardware Reference Manual
DIL/NetPC ADNP/ESC1 Hardware Reference Manual

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Notes to this Document (DNPSK15-FirstStepsE.Doc)

Revision	Date		Name
1.00	14.07.2004	First Version in English (Rev. 1.00)	KDW

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