IGW/900 Device Server
Linux Starter Kit

User Manual

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For further information regarding our products please visit us at www.ssv-comm.com

CONTENT

1 INTRODUCTION

The focus of the IGW/900 is on safe communication via Ethernet technology in an industrial environment. The IGW/900 offers therefore a 10/100Mbps LAN-port which is ready to integrate the IGW/900 into various industrial solutions. Of course the purpose of this Device Server is not limited only to communicate via Ethernet. With the additional serial interface and the CAN support there are plenty of ideas to realize.

This document describes how to start with the IGW/900. For further information about the individual components of this product you may follow the links from our website at *http://www.ssv-comm.de.*

Our Website contains a lot of technical information, which will be updated in regular periods.

1.1 Conventions used in this Document

Convention	Usage
italic	Filenames, Internet addresses like e.g. *www.ssv-embedded.de*
bold italic	User inputs, command lines and pathnames
bold	Important terms
`monospace`	Program code
UPPERCASE	Keyboard buttons like e.g. ENTER

Table 1-1: Convention usage

1.2 Checklist

Compare the content of your IGW/900 package with the standard checklist below. If any item is missing or appears to be damaged, please contact SSV Embedded Systems.

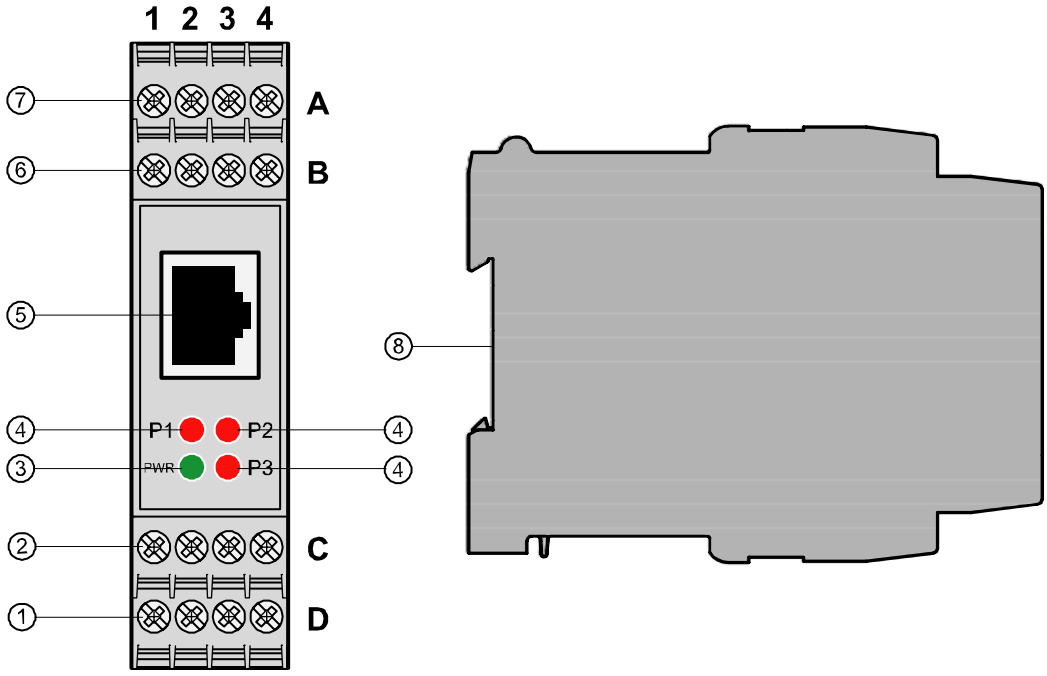
Standard items of the Starter Kit

- ✓ IGW/900 Linux Device Server
- ✓ Power supply
- ✓ Power adapter cable
- ✓ Null-modem cable
- ✓ RS232 adapter cable
- ✓ RCM cable bridge
- ✓ Support CD-ROM
- ✓ Screwdriver

1.3 Features IGW/900

- One 10/100Mbps Ethernet interface
- One CAN interface via screw terminals
- One RS232 serial interface via screw terminals (COM1)
- One RS232 / RS422 / RS485 serial interface via screw terminals (COM2)
- Power LED
- Three general purpose LEDs
- DIN-rail mounting
- DNP/5280 with 32-bit Motorola Coldfire 66 MHz
- 16 MB SDRAM
- 8 MB Flash
- Full programmable
- Pre-installed embedded Linux
- 12 – 24V DC supply voltage

2 IGW/900 OVERVIEW



① Screw terminal D1 - D4
② Screw terminal C1 - C4
③ Power LED
④ Port LEDs P1, P2, P3
⑤ Ethernet interface
⑥ Screw terminal B1 - B4
⑦ Screw terminal A1 - A4
⑧ DIN-rail mounting

Figure 2-1: IGW/900 overview

3 IGW/900 COMPONENTS

This chapter describes the components of the IGW/900 shown in **chapter 2** and gives a short overview about their respective functions.

3.1 Power LED

This green LED lights up when the board is provided with the necessary operating voltage of 12 – 24 V DC.

3.2 General Purpose LEDs

The three red LEDs are for general purpose. Table 3-1 shows their assignment.

LED	Signal
PWR	fix 3.3 V DC
P1	PIO Port PA4
P2	PIO Port PA5
P3	PIO Port PA3

Table 3-1: Assignment of the general purpose LEDs

Note: Each Port LED is on when there is a high level signal on the respective PIO Port available.
Signal low (0) – LED off
Signal high (1) – LED on

3.3 Ethernet Interface

The IGW/900 offers Ethernet connectivity with a speed up to 100Mbps. The RJ45 Ethernet interface of the IGW/900 automatically detects the connection speed and switches to 10Mbps or to 100Mbps mode.

3.4 Screw Terminals

With the adapter cables you can connect the power supply and different devices to the screw terminals on the IGW/900.

Please see **chapter 4.2** how to connect the power supply.
Please see **chapter 4.4** how to create a RS232 serial link.
Please see **chapter 4.5** how to create a RS422 serial link.
Please see **chapter 4.6** how to create a RS485 serial link.
Please see **chapter 4.8** how to create a CAN connection.

3.5 DIN-Rail Mounting

The DIN-rail mounting allows a quick and easy connection of the IGW/900 on a DIN-rail. Please see **chapter 4.1** for a detailed mounting instruction.

4 CONNECTIONS

For a quick and easy start with the IGW/900 there are several connections necessary. The following chapter describes, how and between which components these connections have to be made.

4.1 Mounting the IGW/900 on a DIN-Rail

To mount the IGW/900 on a DIN-rail is very simple. To click the IGW/900 on the DIN-rail, just hinge the device into the upper edge of the DIN rail. Then press it downwards to compress the spring inside the DIN-rail mounting unit (1). After this, push the IGW/900 against the DIN-rail as to snap it on.

The figure 4-1 shows these steps.

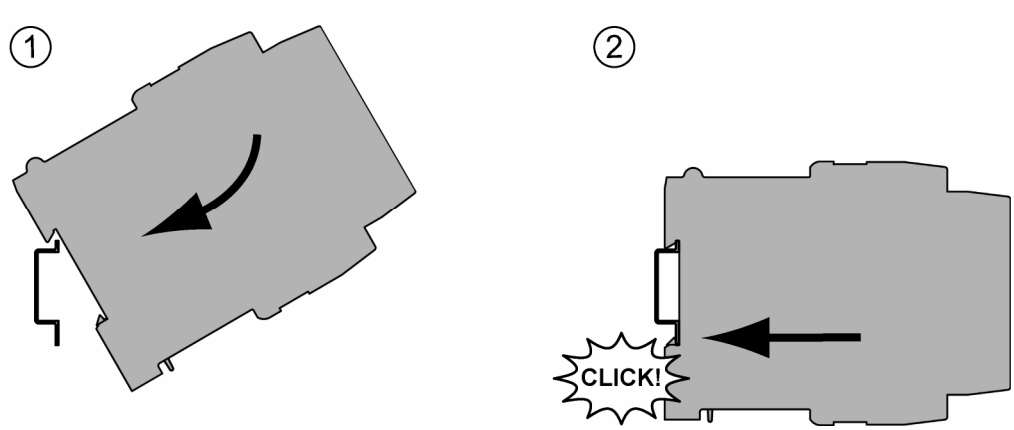
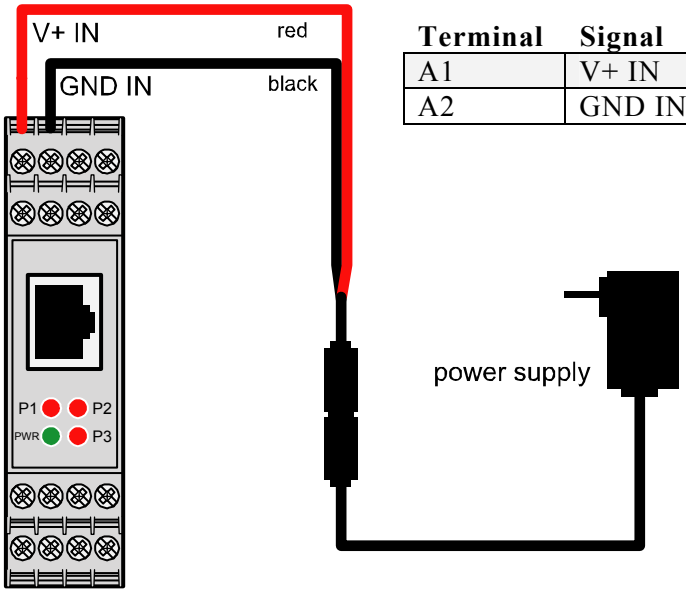


Figure 4-1: Mounting the IGW/900 on a DIN-rail

To snap the IGW/900 off, pull the plastic disassembling lever on the bottom of the IGW/900 downwards with the aid of a screwdriver and remove the device from the DIN-rail.

4.2 Providing the IGW/900 with Power

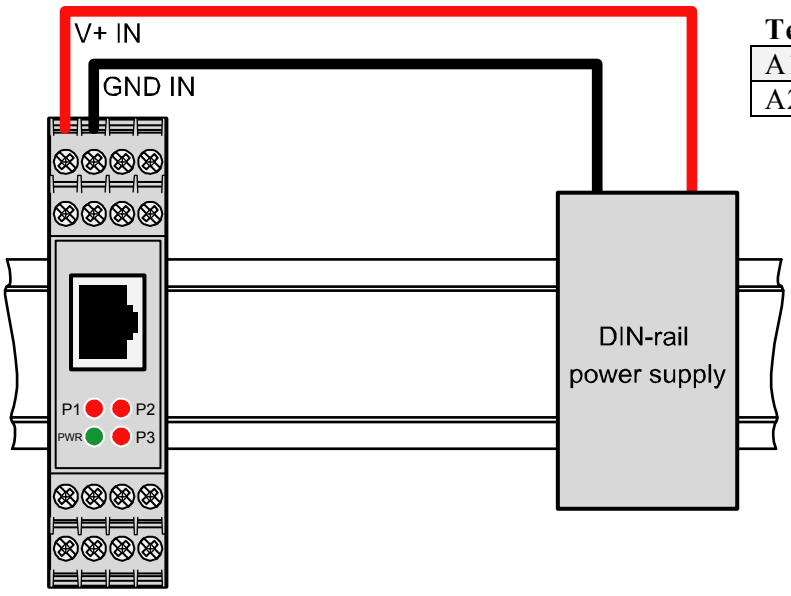
The IGW/900 needs a supply voltage of 12 – 24 V DC to work. In your IGW/900 Starter Kit you will find a plug-in power supply unit and a power adapter cable to provide the system with the necessary power in a software development environment.



Terminal	Signal
A1	V+ IN
A2	GND IN

Figure 4-2: Connecting the IGW/900 with the power supply for software development

The next figure shows how to provide the IGW/900 with power in an industrial environment on a DIN-rail.



Terminal	Signal
A1	V+ IN
A2	GND IN

Figure 4-3: Providing the IGW/900 with power in an industrial environment on a DIN-rail

Note: To provide the IGW/900 on a DIN-rail with power, you need a special DIN-rail power supply, which is not part of the IGW/900 Starter Kit.

4.3 Ethernet Link

The Ethernet link can be made on two ways. First with a crossover cable and second with two standard 10/100Mbps patch cables and a hub or switch. In both cases an Ethernet-LAN interface for your host is required. If you use a hub or switch please connect them between your host and the IGW/900 like shown in the figure below.

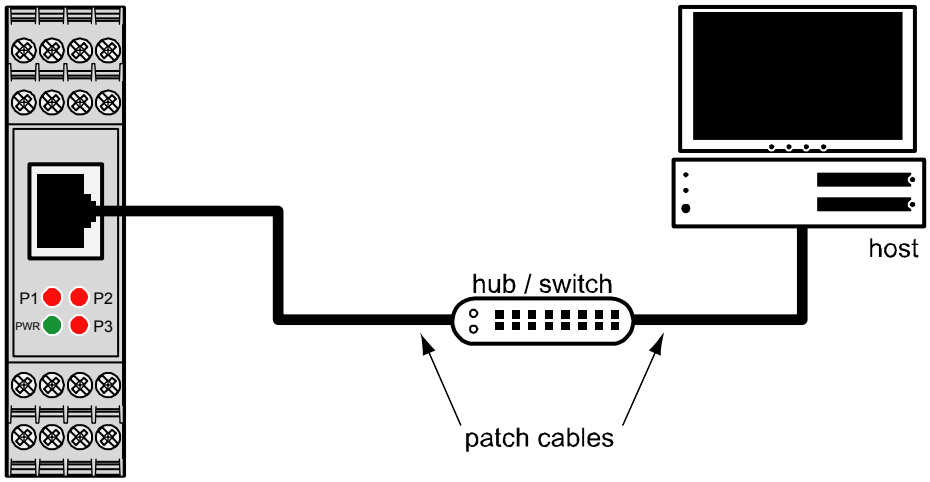


Figure 4-4: Ethernet link with hub/switch

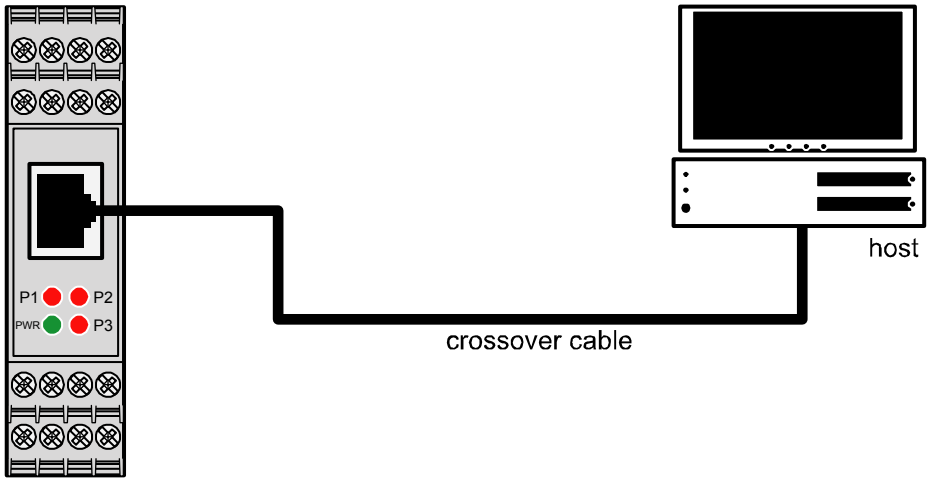


Figure 4-5: Ethernet link with crossover cable

4.4 RS232 Serial Link

For a basic communication with the IGW/900 use the RS232 adapter cable and the null modemcable on port COM1 of the IGW/900. These cables come along with your IGW/900 Starter Kit. Please connect the IGW/900 with the COM port of your host by using these cables.

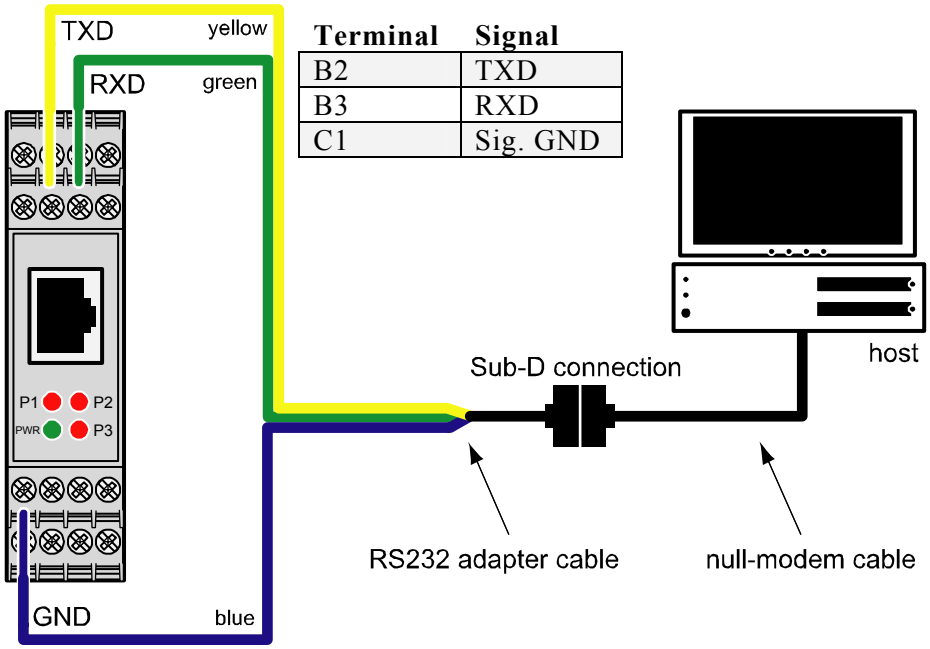


Figure 4-6: RS232 serial link on port COM1

To create a RS232 serial link on port COM2 of the IGW/900 connect the RS232 adapter cable and the null modemcable like shown in the figure below.

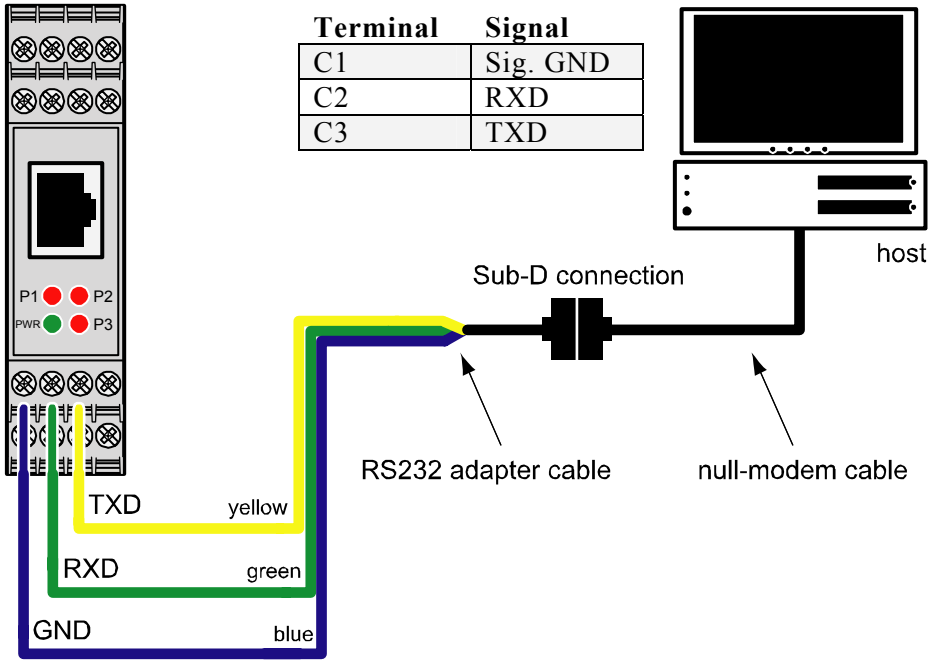
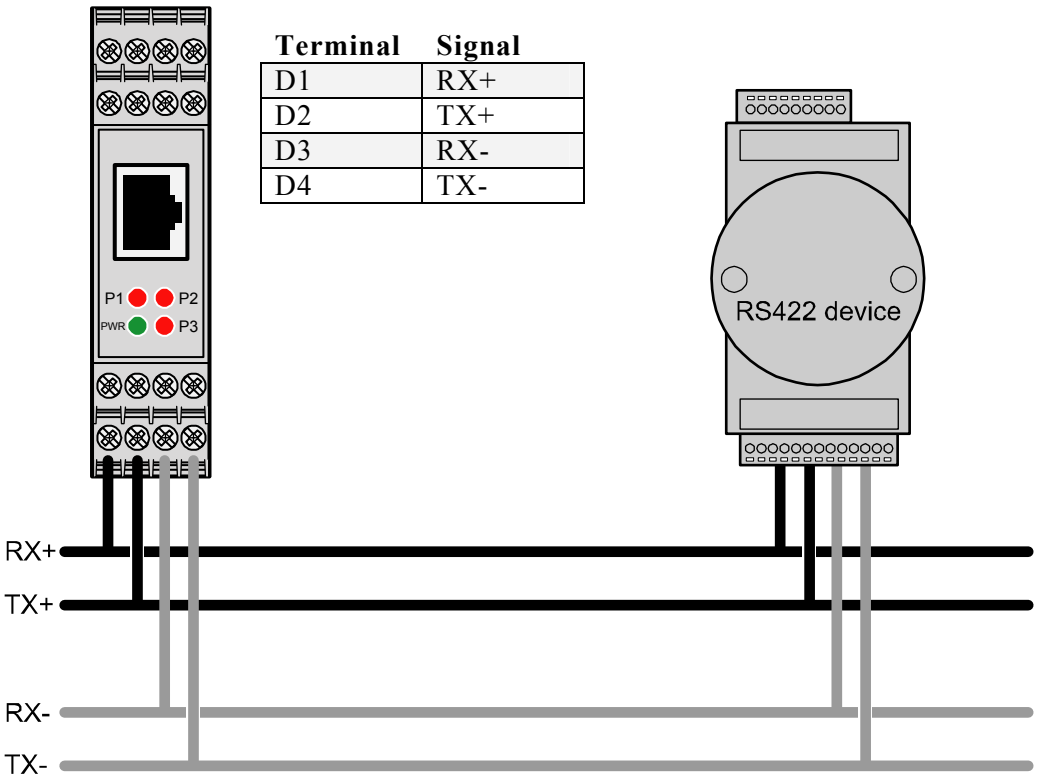


Figure 4-7: RS232 serial link on port COM2

4.5 RS422 Serial Link

The RS422 mode allows you to integrate corresponding 4-wire bus systems into a TCP/IP network with the help of the IGW/900. For RS422 communication connect the wires between the IGW/900 and a RS422 device like shown in the figure below.

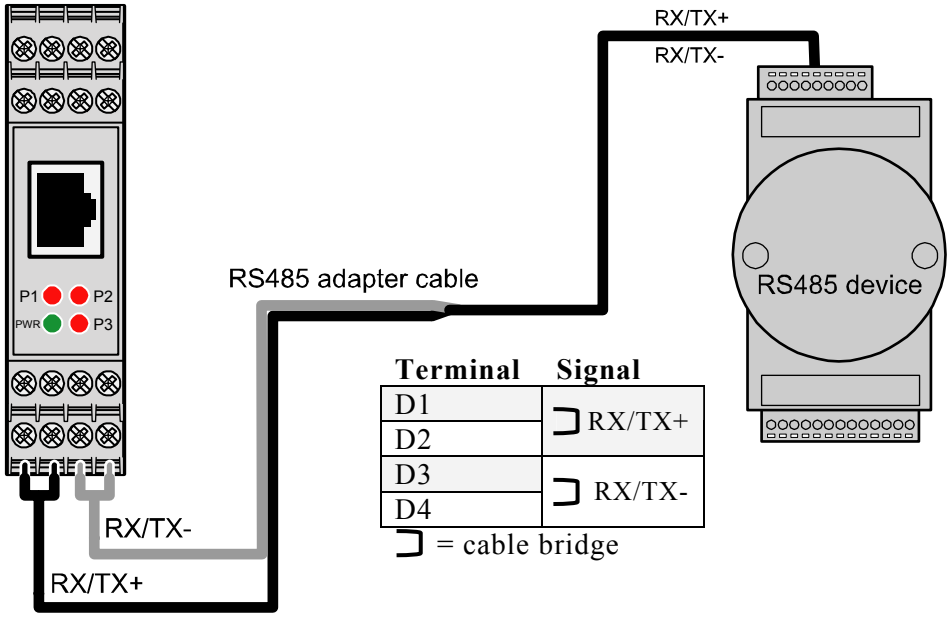


Terminal	Signal
D1	RX+
D2	TX+
D3	RX-
D4	TX-

Figure 4-8: RS422 serial link

4.6 RS485 Serial Link

The RS485 mode allows you to integrate corresponding 2-wire bus systems into a TCP/IP network with the help of the IGW/900. For RS485 communication between the IGW/900 and a RS485 device (e.g. a data acquisition module) you have to use a RS485 adapter cable. This cable is not included in your IGW/900 Starter Kit.



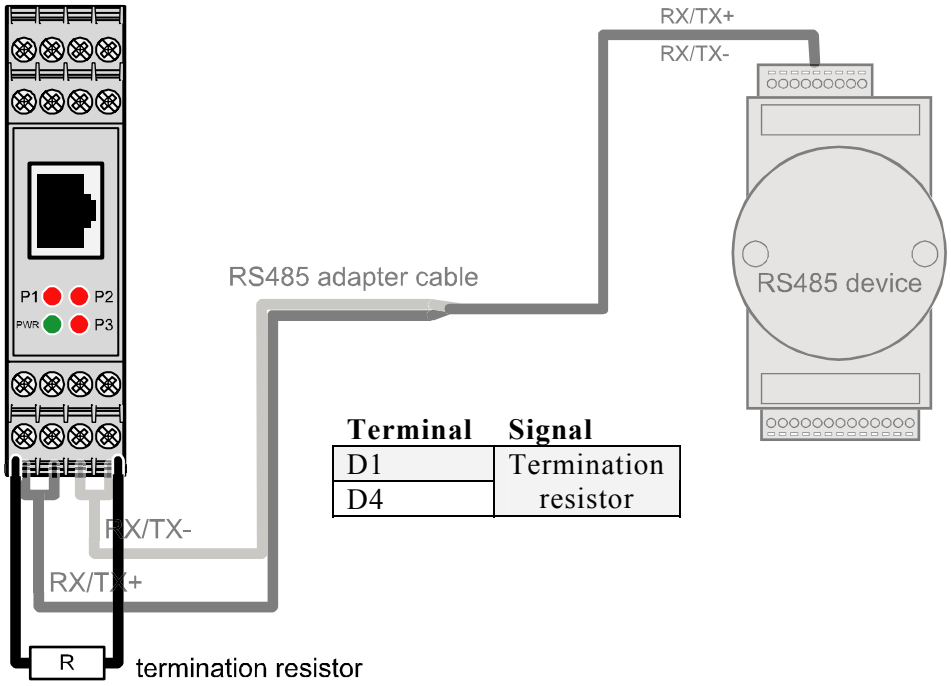
Terminal	Signal
D1	⊐ RX/TX+
D2	
D3	⊐ RX/TX-
D4	

⊐ = cable bridge

Figure 4-9: RS485 serial link

4.7 Termination Resistor for the RS485 interface

By using the RS485 interface of the IGW/900 the bus line must be terminated at the two most distant bus ends. To terminate the RS485 bus line, a termination resistor has to be connected with the IGW/900. The next figures show how to connect a termination resistor to the IGW/900.



Terminal	Signal
D1	Termination resistor
D4	

Figure 4-10: Connection of the termination resistor for a RS485 serial link

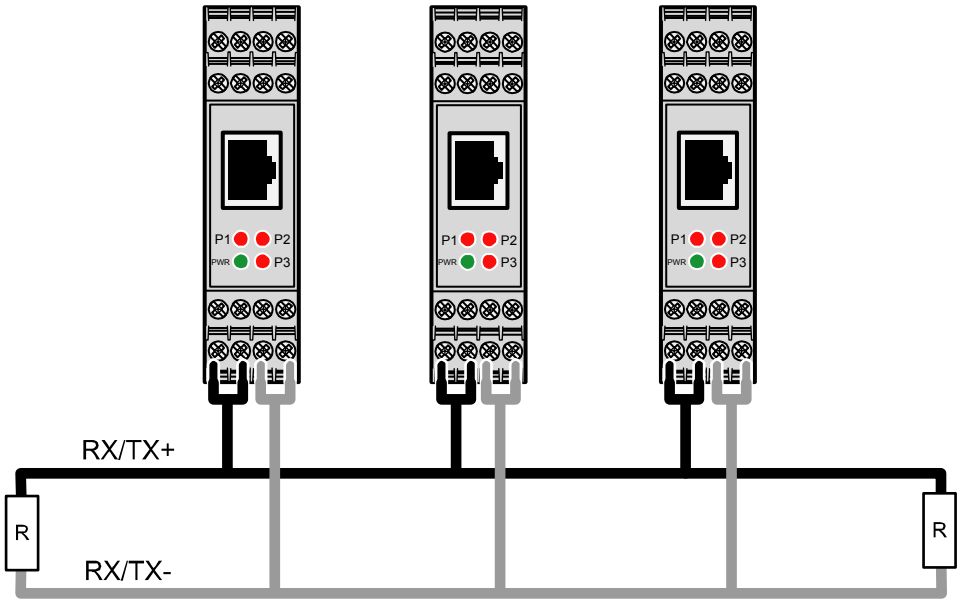
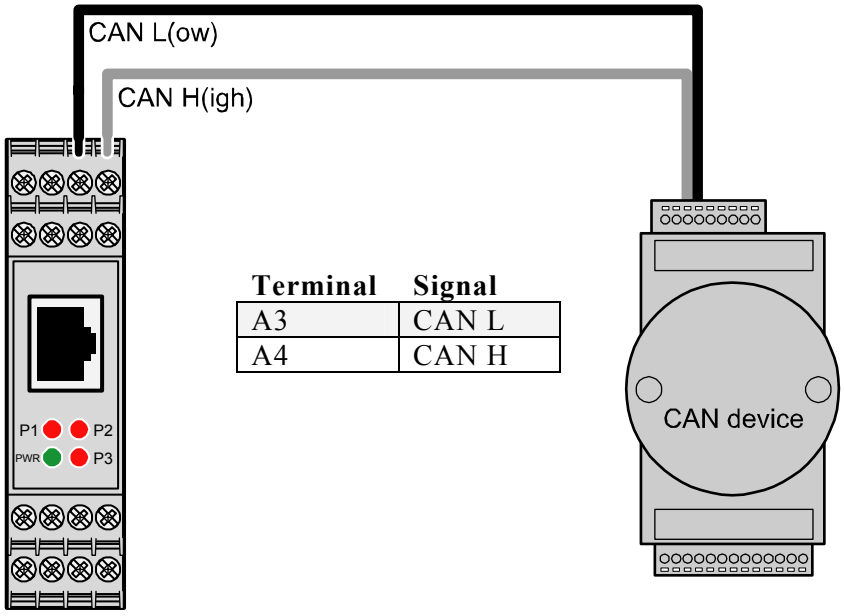


Figure 4-11: Connection of the termination resistor for a RS485 serial link

4.8 CAN Connection

The CAN mode allows you to integrate corresponding 2-wire bus systems into a TCP/IP network with the help of the IGW/900. For CAN communication between the IGW/900 and a CAN device you have to use a suitable cable. This cable is not included in your IGW/900 Starter Kit.

To create a CAN connection just connect the screw terminals A3 and A4 with a cable like shown below.

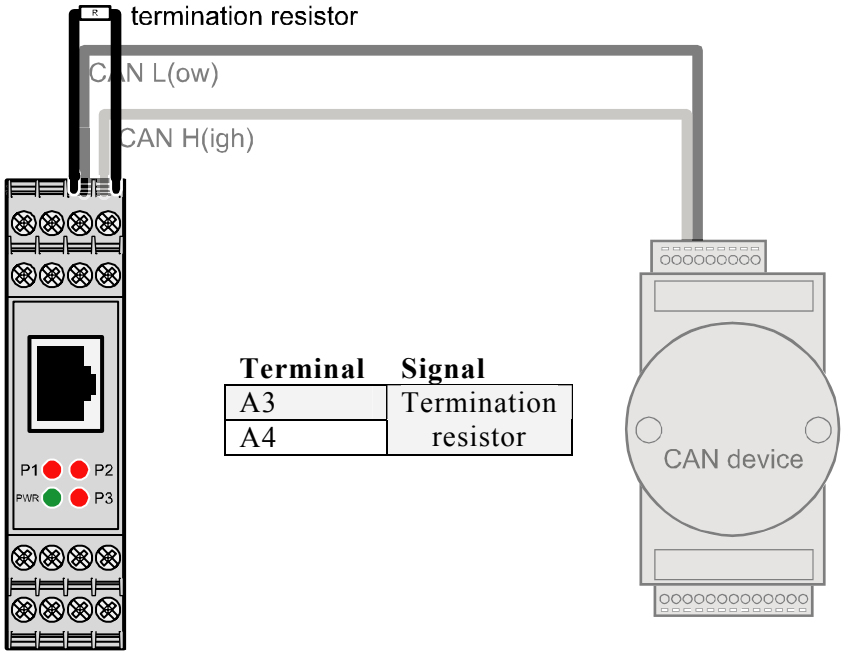


Terminal	Signal
A3	CAN L
A4	CAN H

Figure 4-12: CAN connection

4.9 Termination Resistor for the CAN Connection

By using the RS485 interface of the IGW/900 the bus line must be terminated at the two most distant bus ends. To terminate the RS485 bus line, a termination resistor has to be connected with the IGW/900. The next figures show how to connect a termination resistor to the IGW/900.



Terminal	Signal
A3	Termination resistor
A4	

Figure 4-13: Connection of the termination resistor for a CAN connection

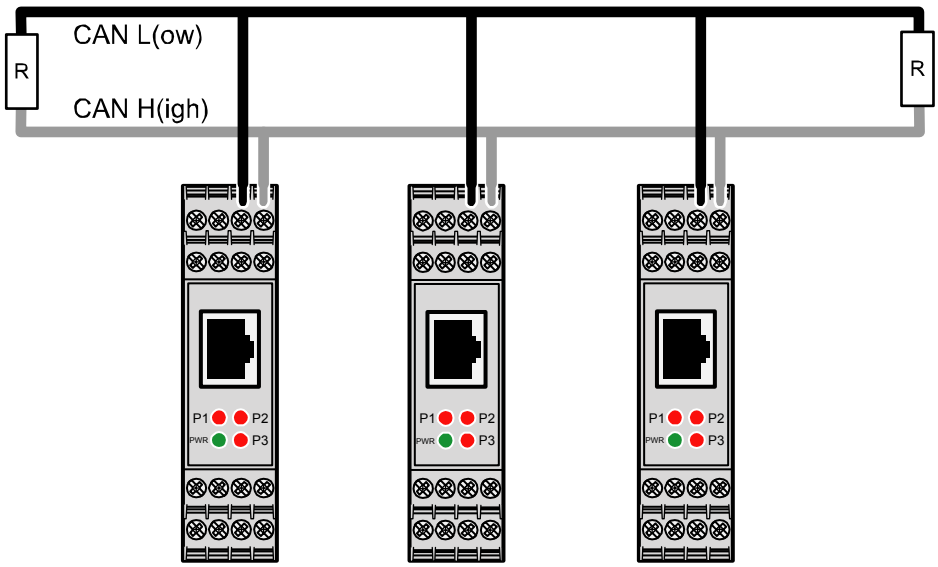


Figure 4-14: Connection of the termination resistor for a CAN connection

4.10 RCM (Remote Console Mode)

The **Remote Console Mode** realizes some basic operating modes such as a boot loader or a ROM-monitor program (Motorola-dBUG) which can be used for different service purposes like setting the IP-address.

The default setting of RCM is disabled. If RCM is disabled, the IGW/900 will boot with µCLinux and you can only communicate via Telnet.

Only with RCM enabled you can use a serial console like HyperTerminal for MS Windows or Minicom for Linux to interact with the IGW/900.

To enable RCM on the IGW/900 just connect the screw terminals C1 and C4 with a cable bridge like shown below.

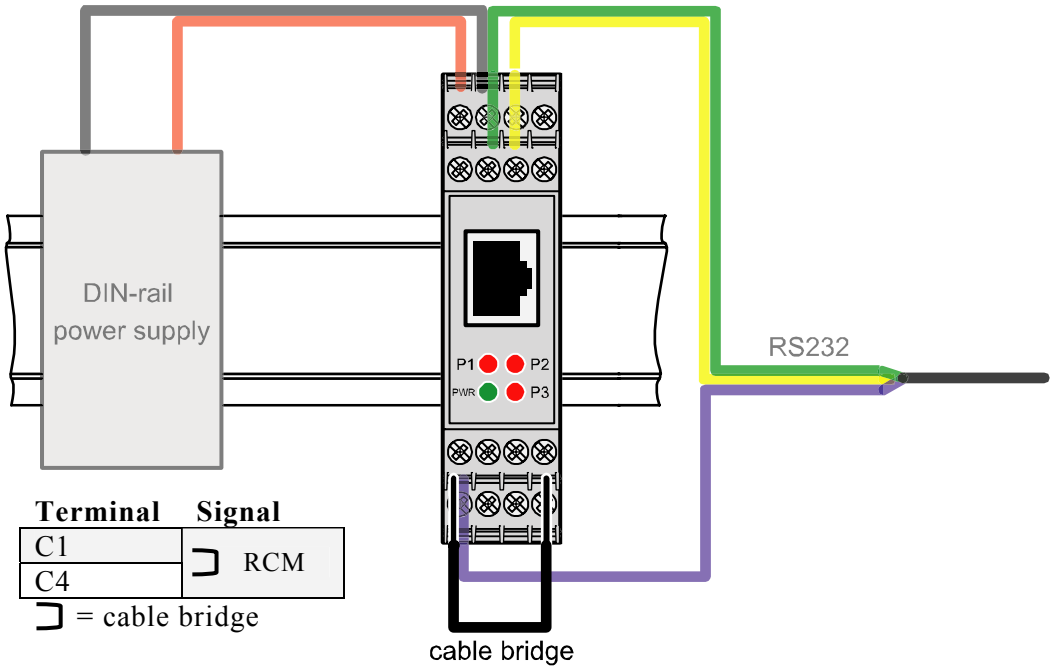


Figure 4-15: Activation of RCM on the IGW/900

5 USING A WINDOWS-BASED HOST

The “heart” of the IGW/900 is the programmable DIL/NetPC DNP/5280. The following paragraphs will help you to use the DNP/5280 with a host running under MS-Windows. For these steps you need a terminal program like **HyperTerminal**, which normally comes along with every MS-Windows installation. Please make sure that this program is present on your host. If this program is not installed on your host, you have to install this program manually from your MS-Windows installation CD-ROM.

5.1 Setup the Serial Link

Before you provide the IGW/900 with power for the first time, please run a terminal program that offers communication capabilities on your host. In the following you will see the necessary settings for HyperTerminal under MS Windows. Select the "direct link cable connection via COM1" interface (or any other appropriate COM-port of the host) in the dialog box and choose "OK".

Figure 5-1: Interface dialog box

Now you can change some configuration parameters – such as the maximum baud rate – on a further dialog box. Select the value "115.200" in the "bits per second" field and close the dialog box by clicking the "OK" button, as shown in the next figure.

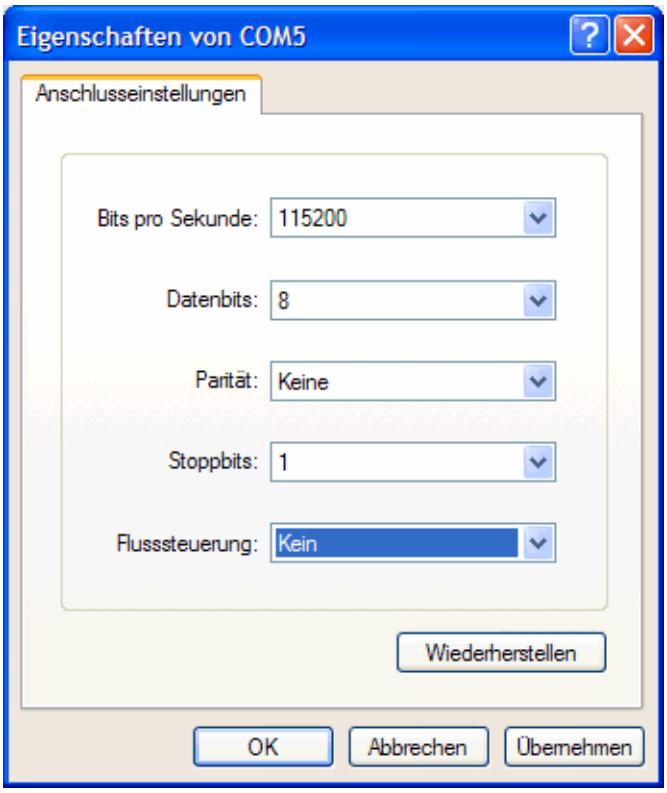


Figure 5-2: Communication parameter settings

All these settings can also be used for other terminal programs. The following parameters are important to use:

- Connection speed 115.200 bps (bits per second)
- 8 data bits
- No parity bit
- 1 stop bit
- No protocol (Xon/Xoff, RTS/CTS or similar).

Now turn on the power for the IGW/900 and you will see all steps of the DNP/5280 boot process in the terminal program window at your PC. If you do not see the following boot process, please make sure that RCM is not enabled (please see **chapter 3.5** for detailed information).

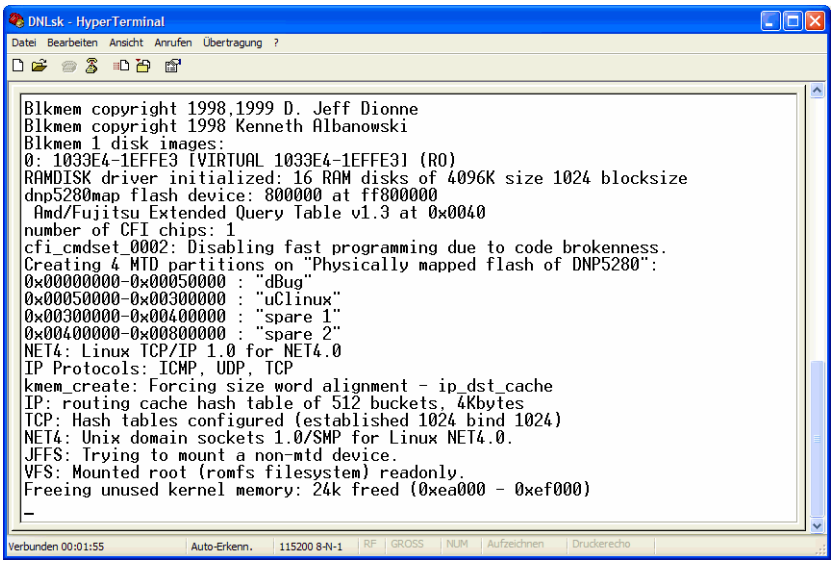


Figure 5-3: Linux boot process

After the self test sequence is done the Linux boot process will be initialized. When finished, you will see the following screen with a Linux prompt which is waiting for a user input.

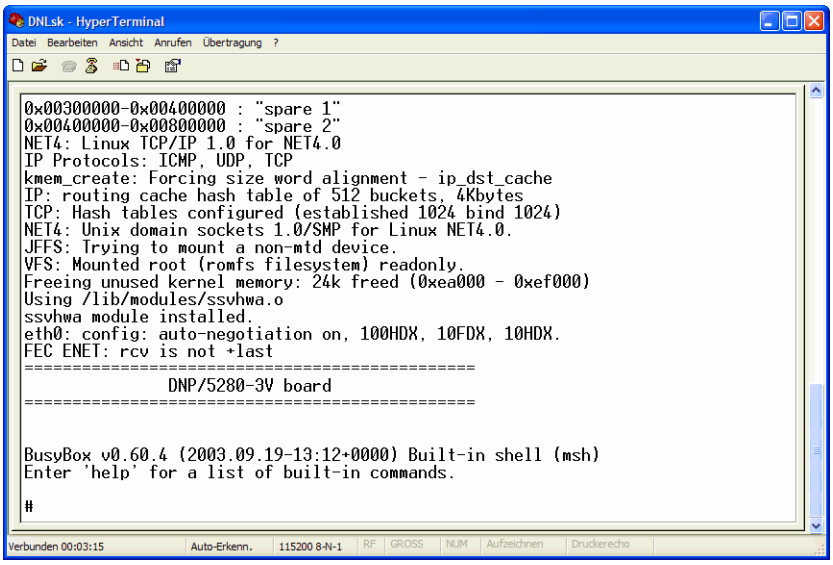


Figure 5-4: Linux command prompt

Now please enter ***ifconfig*** to see the network interface addresses of the DNP/5280 inside of the IGW/900.

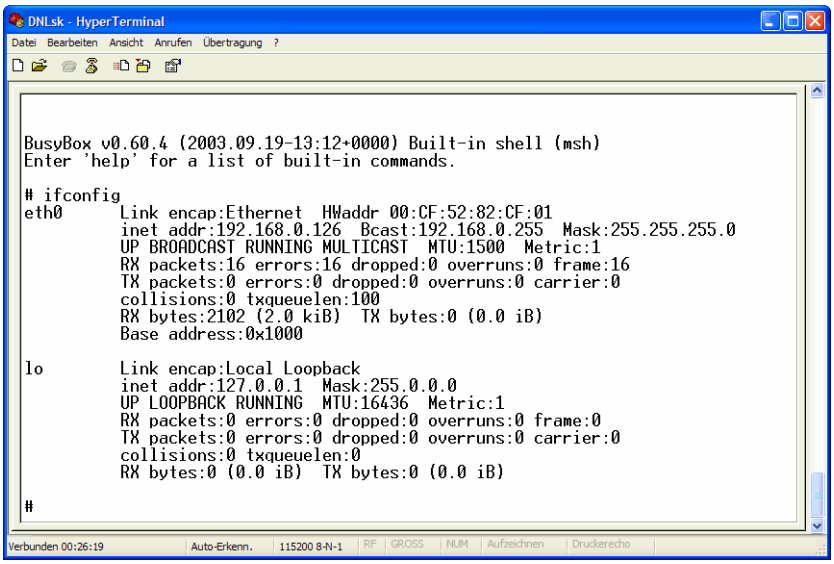


Figure 5-5: Network interface addresses

Note: For a first test of the Ethernet connection between the host and the DNP/5280 inside of the IGW/900 you have to change the assigned IP-address of your host to **192.168.0.254**.

To change the IP-address under MS-Windows just click "Start➲Settings➲Control Panel➲Network➲TCP/IP" and enter the new IP-address. Please make sure, that you do not use another IP-address – this will lead to different network problems.

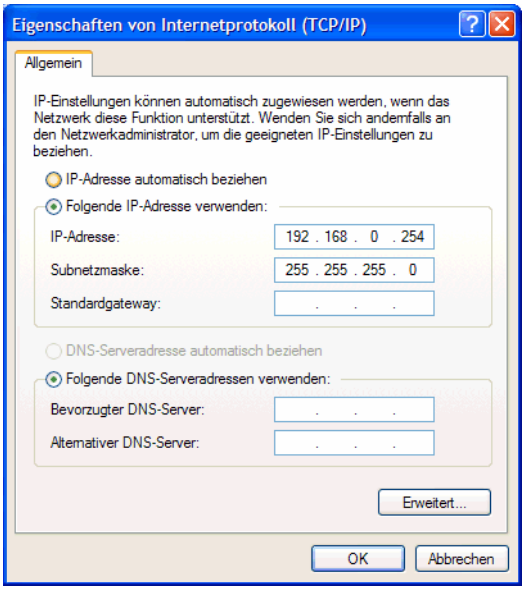


Figure 5-6: Windows IP address settings

5.2 Checking the Ethernet Link

To test the TCP/IP-communication we use PING a very popular TCP/IP-utility program. Please open a DOS window (you can find it in the Windows Start menu) and enter:

ping 192.168.0.126

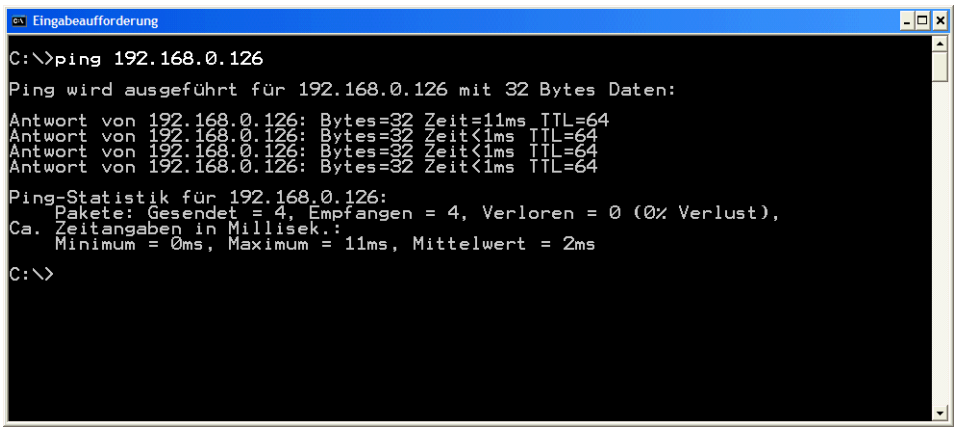


Figure 5-7: Communication check via PING

The IGW/900 must answer this ping. Otherwise an error will occur. In this case you have to check all parts of your LAN-connection, including the IP-address of the host. The correct value of the IP-address is "192.168.0.254". For an easy check of the IP-address within the DOS window, you can use the following DOS-command:

ipconfig

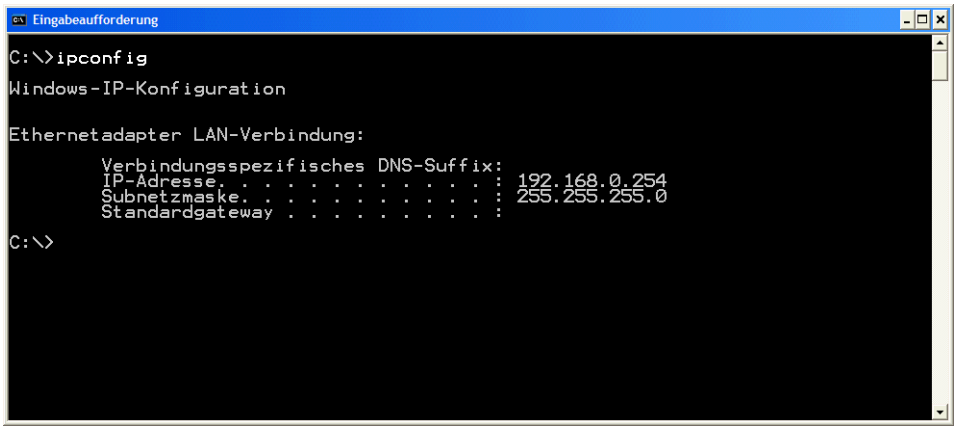


Figure 5-8: Communication check via ipconfig command

Once the ping was successful, you are ready to start a web browser on your development PC. This browser may be the MS Internet Explorer or a different suitable web browser like Netscape or Opera or similar.

5.3 Web Server Access

Start a web browser and open the URL *http://192.168.0.126*. The embedded web server will deliver you a small description about the DNP/5280 inside of the IGW/900. That's it. Now you are online with the IGW/900 and your web browser is connected to the embedded web server of the DNP/5280 inside of the IGW/900. It shows you a static web page with some pictures.

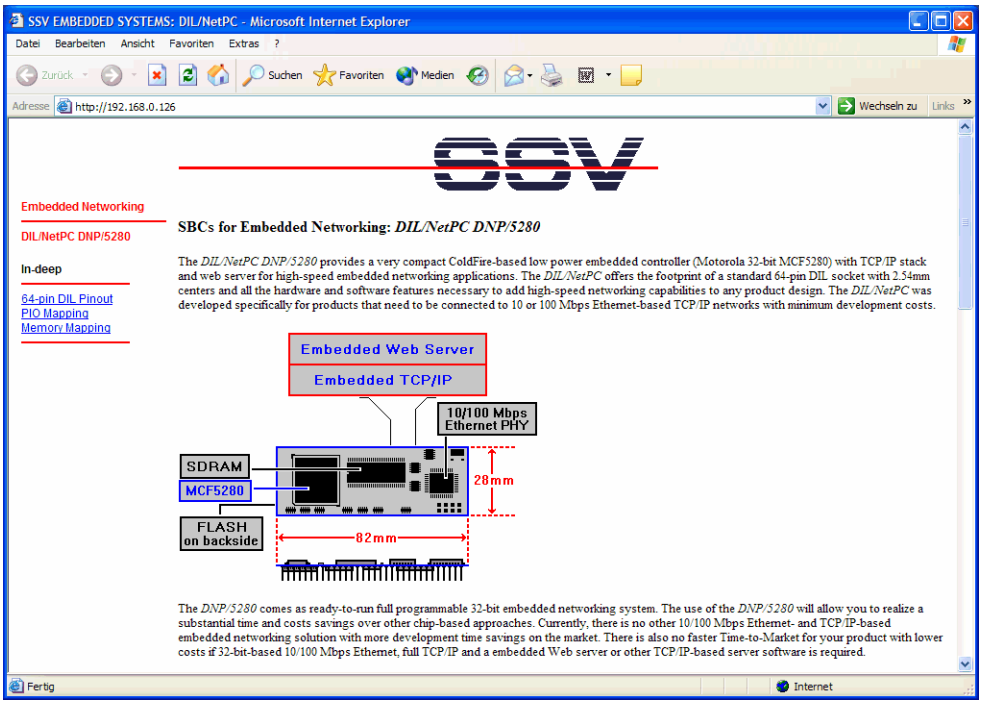


Figure 5-9: Web page shown by the MS-Internet Explorer

If your web browser can't establish a connection to the web server – but the Ping was successful – you should check your browser settings. Please ensure that your browser is joined with TCP/IP by using the Ethernet card in your host. Alternatively you have to install a suitable web browser.

Please make sure that your web browser does not use an Internet proxy server for http-requests. See the web browser connection settings for further details.

In some cases the web browser is only configured for modem based Internet access. In this case, please install a second web browser from your original operating system CD-ROM.

5.4 Assigning a new IP-Address to the IGW/900

The following steps describe how to change the IP-address of the DNP/5280 inside of the IGW/900 with a terminal program like the HyperTerminal-program in MS-Windows.

Note: Please make sure that RCM on the IGW/900 is enabled for further operation. Please see **chapter 3.5** how to enable RCM correctly.

When the DNP/5280 inside of the IGW/900 has booted with RCM enabled you should see the following screen on your terminal program.

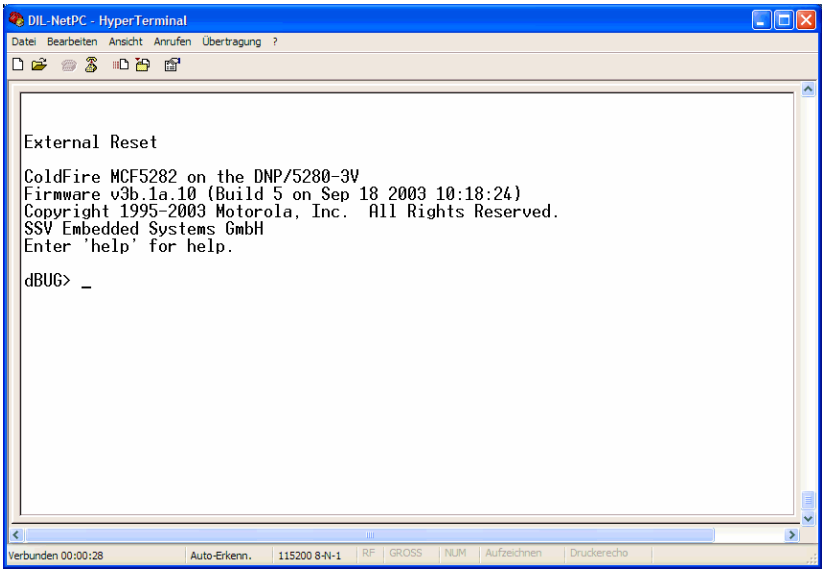


Figure 5-10: Boot process with RCM jumper set

Now enter the command ***show*** to see the current parameters of the DNP/5280 inside of the IGW/900. To assign a different IP-address (e.g. the IP-address 192.168.0.100) use the Linux command ***set client 192.168.0.100***.

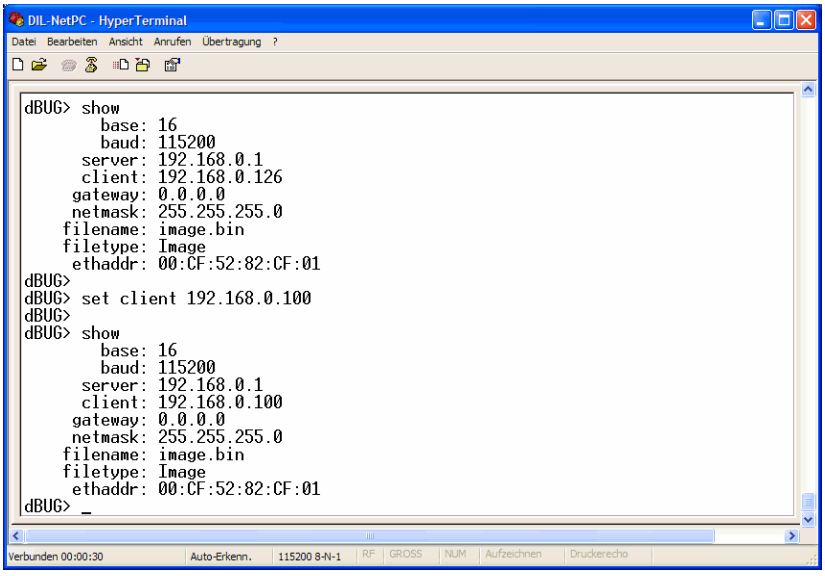


Figure 5-11: Assigning a new IP-address to the DNP/5280

Probably you have to change other parameters as well. The next figure shows you how to use the command set with different parameters.

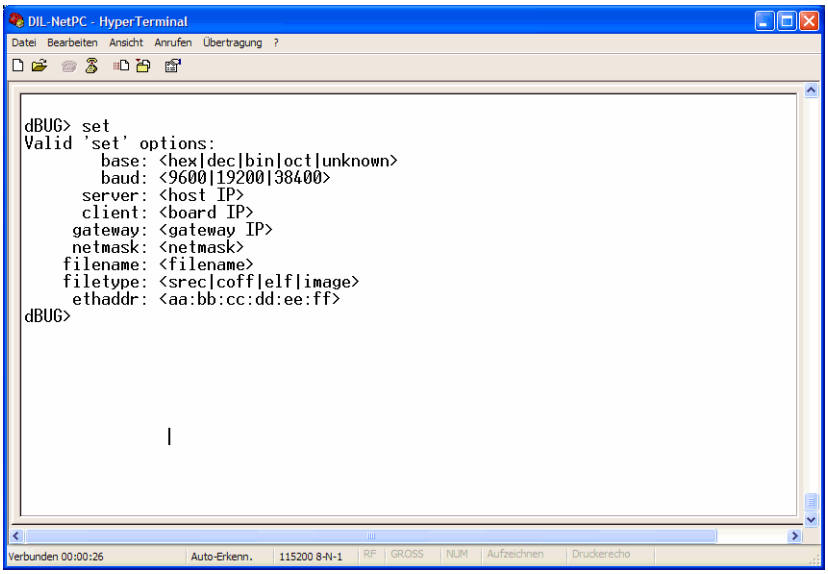


Figure 5-12: Command set with parameters

5.5 Running Linux

The DNP/5280 inside of the IGW/900 is delivered with a pre-installed Linux. When booting make sure RCM of the IGW/900 is disabled. When the Linux boot process is done the system will stop with the login prompt shown in **figure 5-13**.

The DNP/5280 Linux does not need a user login with user name and password. Just enter your Linux commands directly after the boot process.

Note: On every boot process without RCM enabled (please see **chapter 3.5**) there is a serial console available with following parameters: 115.200 bps, no parity, 8 data bits, 1 stop bit, no handshake.

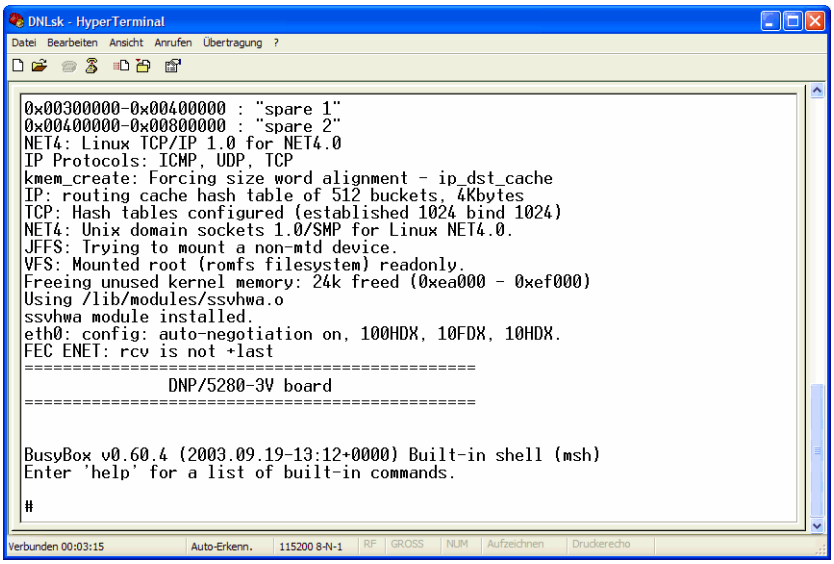


Figure 5-13: DNP/5280 Linux boot process

Alternatively you can use a **command line interface (CLI)** like a Telnet client to communicate with the IGW/900. Open for example a DOS window in MS-Windows and type in the command ***telnet 192.168.0.126***.

If you have already assigned a different IP-address to the IGW/900 you need to enter this new IP-address in the command line.

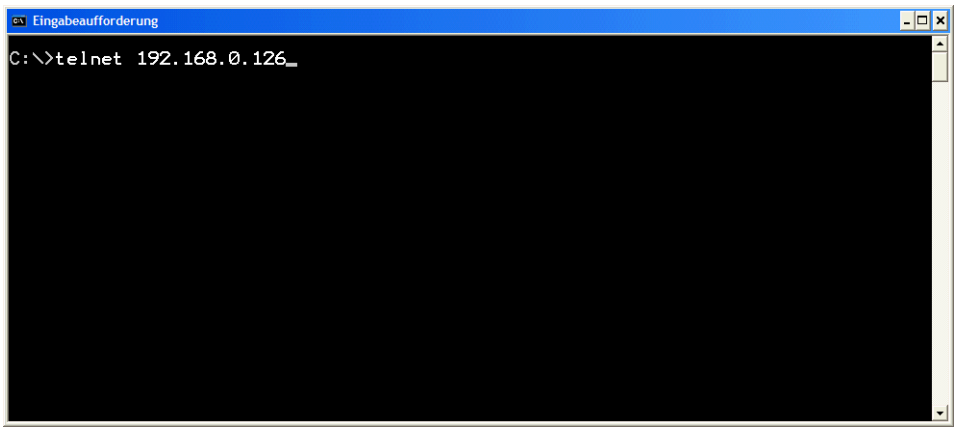


Figure 5-14: Running the MS-Windows Telnet client

Within the Telnet client you can enter Linux commands that will be executed by the IGW/900. The standard output will be shown in your Telnet client window as illustrated in the next figure.

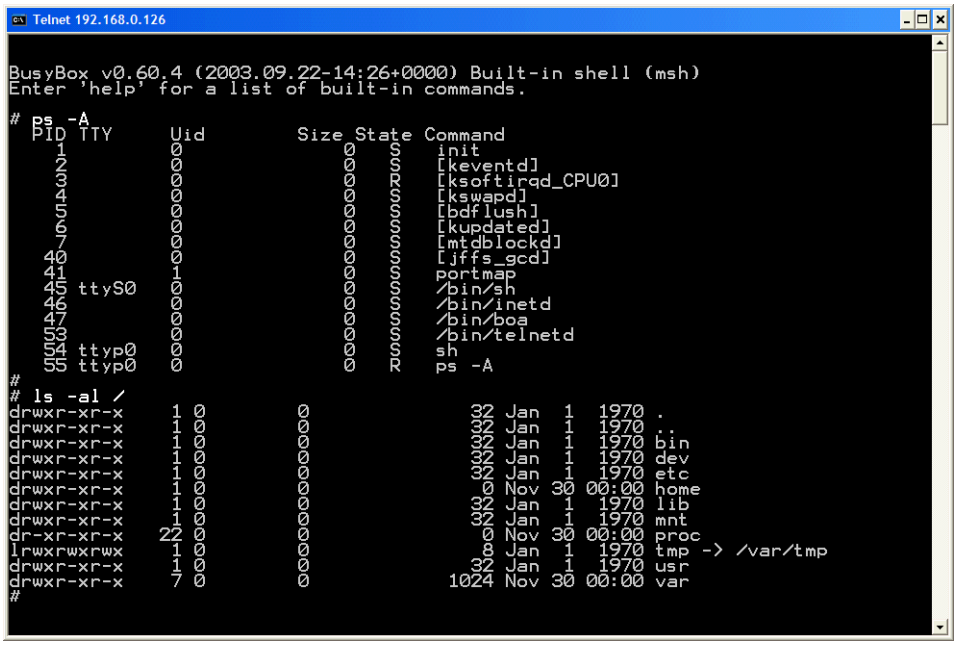


Figure 5-15: Enter Linux commands via Telnet

Note: You can enter Linux commands in different command line interfaces (CLI) like a serial console (e.g. HyperTerminal, Minicom) or a Telnet client.

5.6 Filetransfer via TFTP

The DNP/5280 inside of the IGW/900 offers a very simple way for Ethernet-based file transfers between your PC system and the DNP/5280 RAM disk drives or JFFS-based flash disk drives. This file transfer is using the TCP/IP service **TFTP (trivial file transfer protocol)**.

TFTP is a server/client-based protocol. The DNP/5280 Linux configuration offers a TFTP client program. Your PC needs a TFTP server program.

Note: Windows-based PCs do not offer TFTP server programs. Only special server versions of MS Windows come with a TFTP server program. For all other Windows-based PCs you find the TFTP server program **TFTPD32** in the directory ***\TFTPServer-Win32*** on your Starter Kit CD-ROM. Copy all files from ***\TFTP-Server-Win32*** to a new directory on your Windows-based PC hard disk drive. **TFTPD32** is a free, non-commercial product. Please watch the license.

First you have to setup an Ethernet link between the IGW/900 10/100 Mbps Ethernet interface and the Ethernet interface of your PC system. Check the IP address of your Windows PC system with the ***ipconfig*** command. The default IP address (factory setup) of the DNP/5280 inside of the IGW/900 is **192.168.0.126**.

Now run the TFTP server program on your PC system.

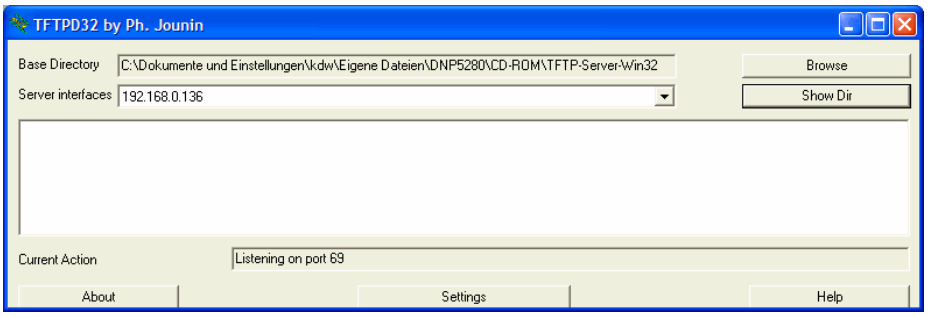


Figure 5-16: Running TFTPD32

Check the TFTP connection between the IGW/900 and your PC system. Open a Telnet session and use the following commands for downloading and uploading files:

tftp –g –l file.name ip-addr
tftp –p –l file.name ip-addr

The command ***tftp*** is the name of the DNP/5280 TFTP client program.

The parameter ***–g*** stands for get (get a file from the PC system to the DNP/5280).

The parameter ***–p*** stands for put (put a file from the DNP/5280 to the PC system).

The parameter ***–l*** file.name specifies the file for put or get.

The parameter ***ip-addr*** stands for the IP address of your PC system (i.e. 192.168.0.1).

Most TFTP server programs work with a default directory for put and get commands. Each TFTP put command writes a file to this directory. Each TFTP get command reads the file from this directory on your PC system. For TFTPD32 you can change this directory with the browse button.

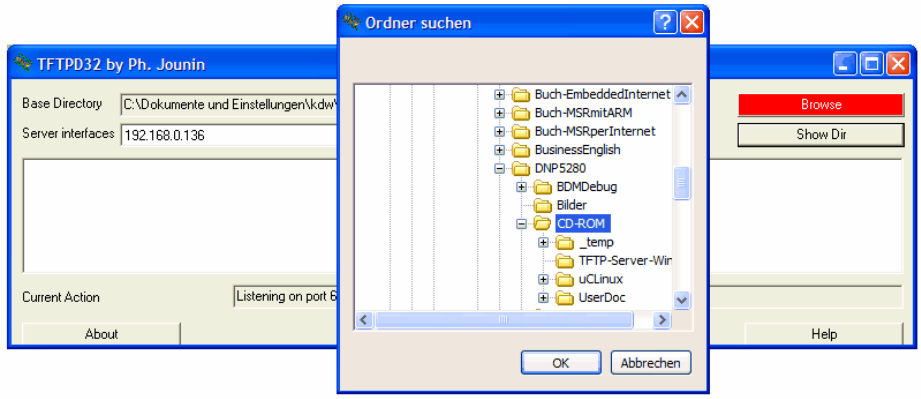


Figure 5-17: Changing the default directory for TFTPD32

Example:

The following picture shows the use of the DNP/5280 TFTP client within a Telnet session.

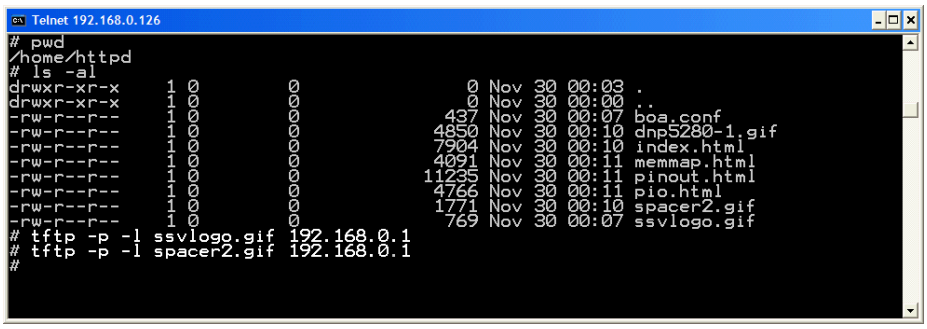


Figure 5-18: Using the DNP/5280 TFTP client within a Telnet session

Note: A file transfer to the DNP/5280 inside of the IGW/900 must be started with a Telnet session from RAM disk or JFFS-based flash disk directories. You need R/W access for the TFTP get command.

6 USING A LINUX-BASED HOST

The “heart” of the IGW/900 is the programmable DIL/NetPC DNP/5280. The following paragraphs will help you to use the DNP/5280 with a host running under Linux. For these steps you will need a terminal program, which normally comes along with the Linux installation (i.e. **Minicom**). Please make sure that this program is present on your host.
If necessary you have to install this program from your Linux installation CD-ROM.

6.1 Setup the Serial Link

Before you provide the IGW/900 with power for the first time, please run a terminal program like Minicom. Minicom is a simple serial communication program originally written by Miquel van Smoorenburg. It offers basic communication capabilities and integrates well with the Linux user interface. Minicom is a lot like the old MS-DOS program PROCOMM. This program can be used to connect a Linux-based PC to embedded devices such as the DNP/5280 inside of the IGW/900 for initial configurations. In the following we will show you how to use Minicom and what you have to do to adjust the necessary settings.

Open a terminal window and type in the command ***minicom -s*** to get access to the serial port settings. Now you can change some configuration parameters – such as the maximum baud rate. Set the serial port parameters for the maximum baud rate on "115.200 bps".

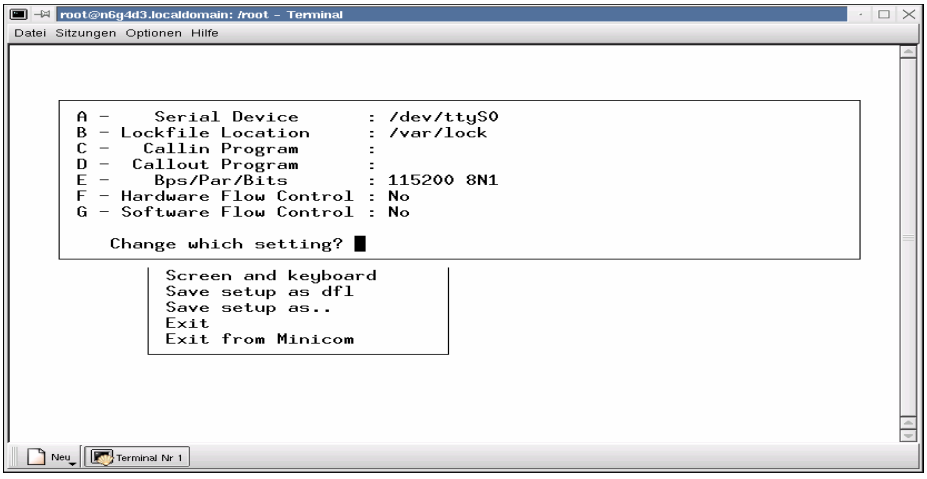


Figure 6-1: Serial port settings under Minicom

Now turn on the power for the IGW/900 and you will see all steps of the boot process in the terminal program window at your PC. If you do not see the following boot process, please make sure that RCM on the IGW/900 is disabled (please see **chapter 3.5** for detailed information).

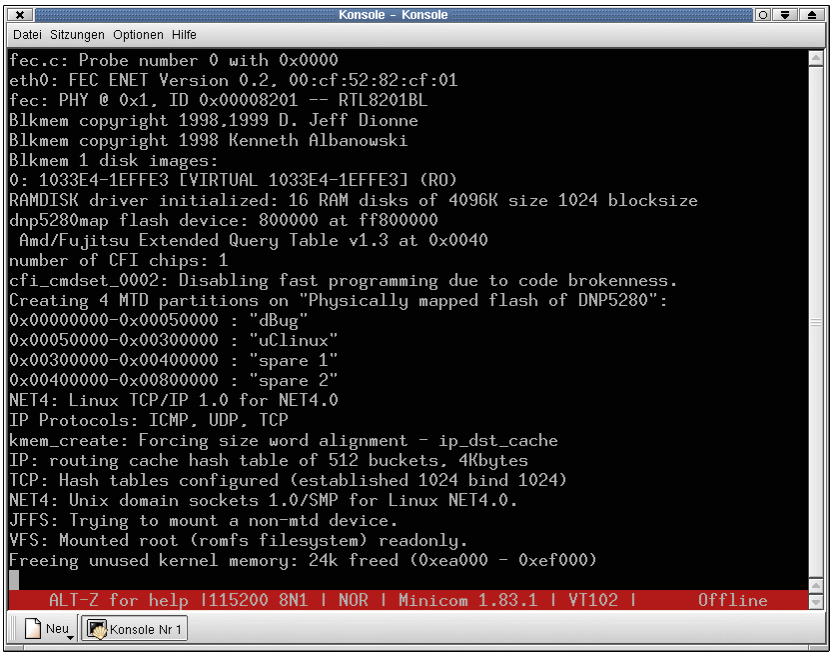


Figure 6-2: Linux boot process

After the self test sequence is done the Linux boot process will be initialized. When finished, you will see the following screen with a Linux prompt waiting for a user input.

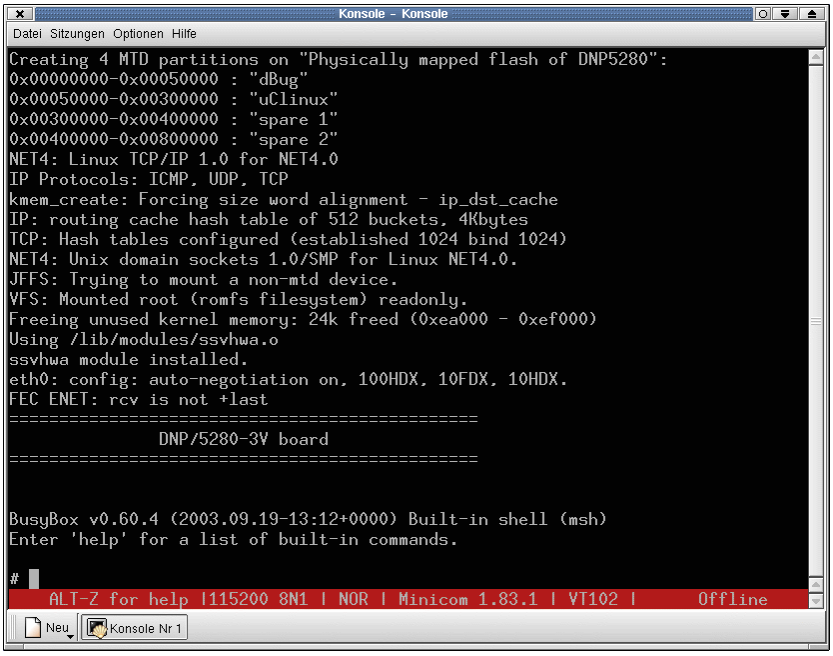


Figure 6-3: Linux command prompt

6.2 Checking the Ethernet Link

Please open a shell window and type in ***ping 192.168.0.126***. Every ping request has to be answered by your DNP/5280 inside of the IGW/900 similar as shown below.

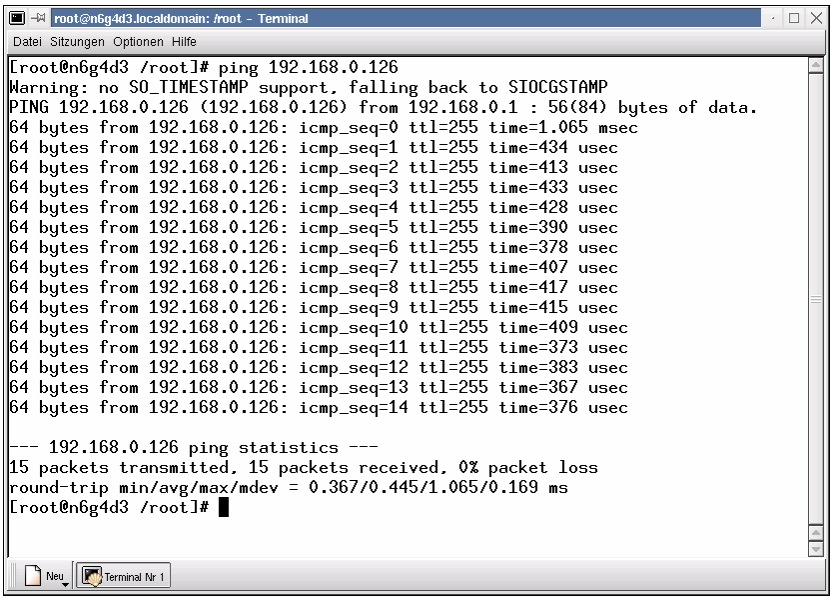


Figure 6-4: Ping request

To cancel the ping request just press the keyboard shortcut CONTROL + C. If an error occurs (e.g. the DNP/5280 does not answer the ping of your host) you have to check your cable connections at first.

Note: For a first test of the DNP/5280 you have to change the assigned IP-address of your host to ***192.168.0.1***. Please make sure, that you do not use another IP-address – this could lead to different network problems.

For an easy check if the IP-address is set correctly to "192.168.0.1", you can use the Linux-command ***ifconfig***.

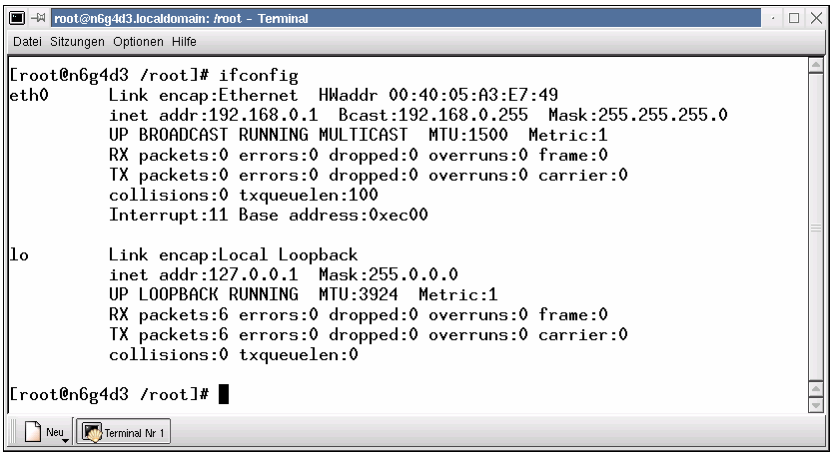


Figure 6-5: IP-address check via ifconfig

6.3 Web Server Access

Once the ping was successful, you are ready to start a web browser on your development system. This may be the Konqueror file manager or the Netscape Communicator/Navigator. The Konqueror file manager is normally part of the Linux installation and acts as file manager as well as web browser. Konqueror is able to detect automatically when an URL is entered and shows the content.

Just enter the URL ***http://192.168.0.126*** and press ENTER. The embedded web server will deliver you a small description about the DNP/5280 inside of the IGW/900.

That's it. You are now online with the IGW/900. The web browser of your development system is connected to the embedded web server of the DNP/5280 inside of the IGW/900 and shows you a static web page with some pictures.

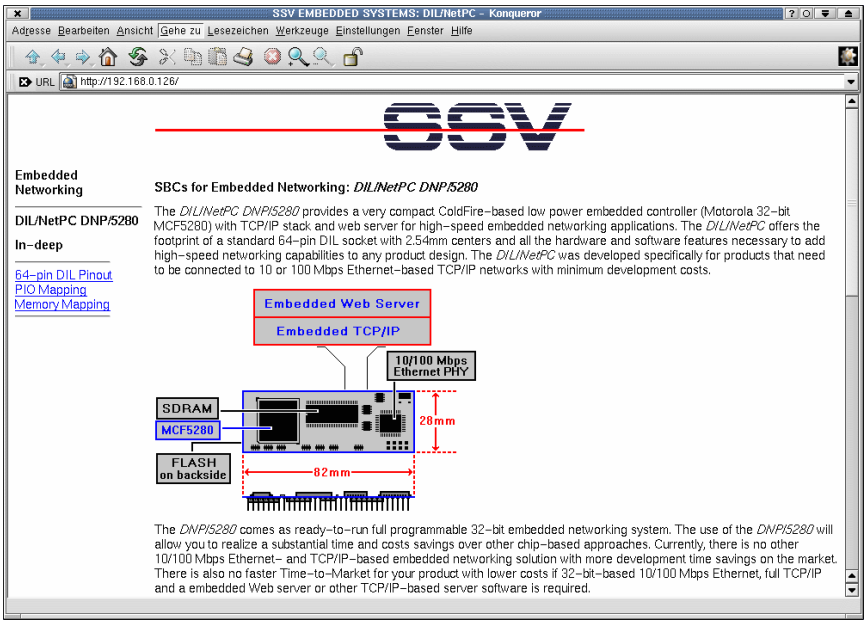


Figure 6-6: Web page shown by the Konqueror File Manager

6.4 Assigning a new IP-Address to the IGW/900

The following steps describe how to change the IP-address of the DNP/5280 with a command line interface like Minicom in Linux.

Note: Please make sure that RCM on the IGW/900 is disabled for further operation. Please see **chapter 3.5** how to enable RCM correctly.

When the IGW/900 has booted with RCM enabled you should see the following messages on your terminal program.

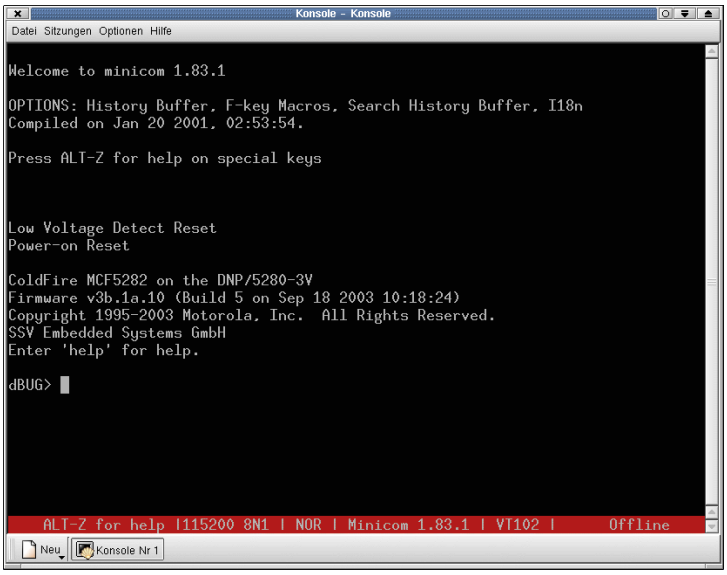


Figure 6-7: Boot process with RCM enabled

Now enter the command ***show*** to see the current parameters of the DNP/5280 inside of the IGW/900. To assign a different IP-address (e.g. the IP-address 192.168.0.100) type in the command line ***set client 192.168.0.100***.

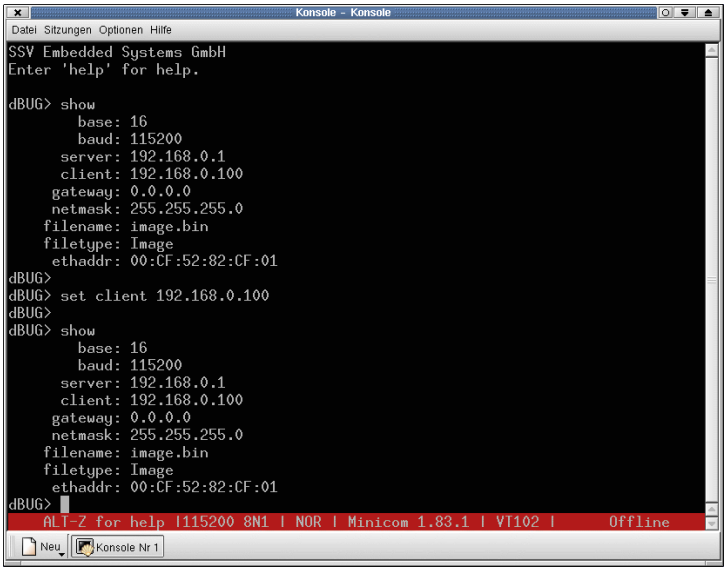


Figure 6-8: Assigning a new IP-address to the IGW/900

Probably you have to change other parameters as well. The next figure shows you how to use the command set with different parameters.

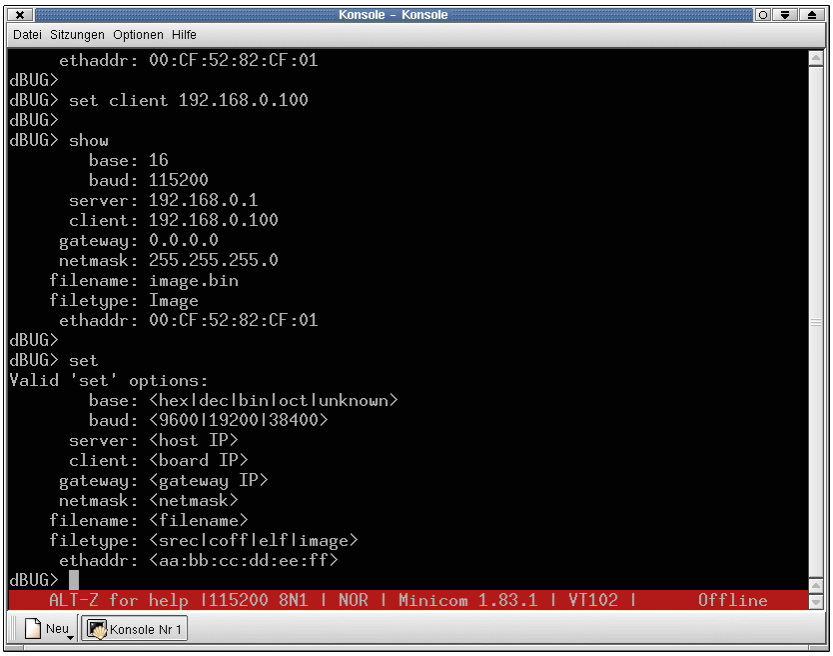


Figure 6-9: Command set with parameters

6.5 Running Linux

The DNP/5280 inside of the IGW/900 is delivered with a pre-installed Linux. When booting make sure RCM of the IGW/900 is disabled. When the Linux boot process is done the system will stop with the login prompt shown in the next figure. The DNP/5280 Linux does not need a user login with user name and password. Just enter your Linux commands directly after the boot process.

Note: On every boot process without RCM enabled (please see **chapter 3.5**) there is a serial console available with following parameters: 115.200 bps, No Parity, 8 Data Bits, 1 Stop Bit, No Handshake.

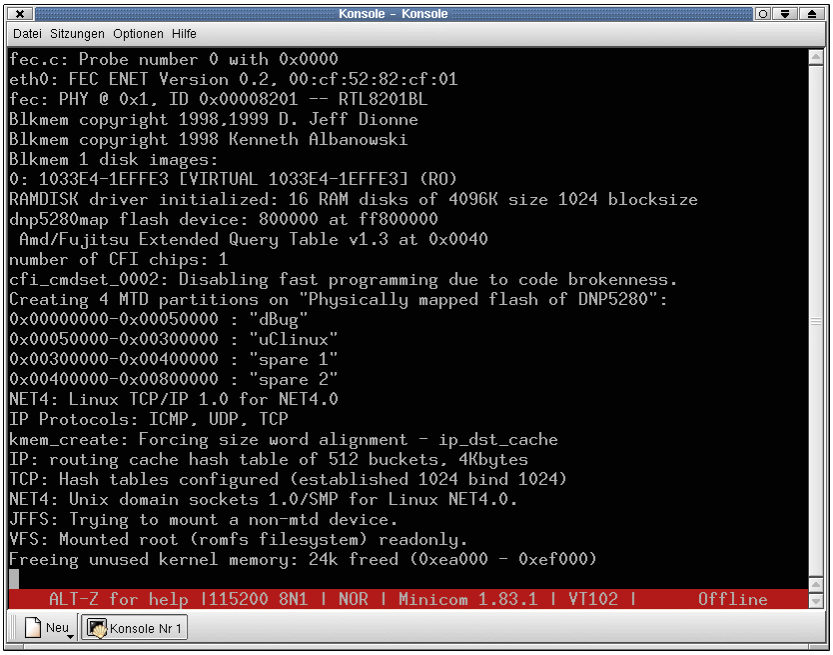


Figure 6-10: Linux boot process

Alternatively you can use a **command line interface (CLI)** like a Telnet client to communicate with the DNP/5280 inside of the IGW/900. Type in the command ***telnet 192.168.0.126***.

If you have already assigned a different IP-address to the DNP/5280 you need to enter this new IP-address in the command line.

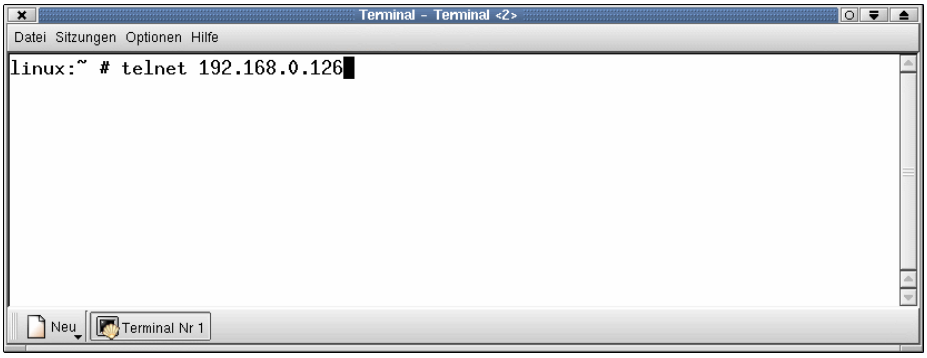


Figure 6-11: Linux login

Within the Telnet client you can enter Linux commands that will be executed by the DNP/5280 inside of the IGW/900. The standard output will be shown in your Telnet client window as illustrated in the next figure.

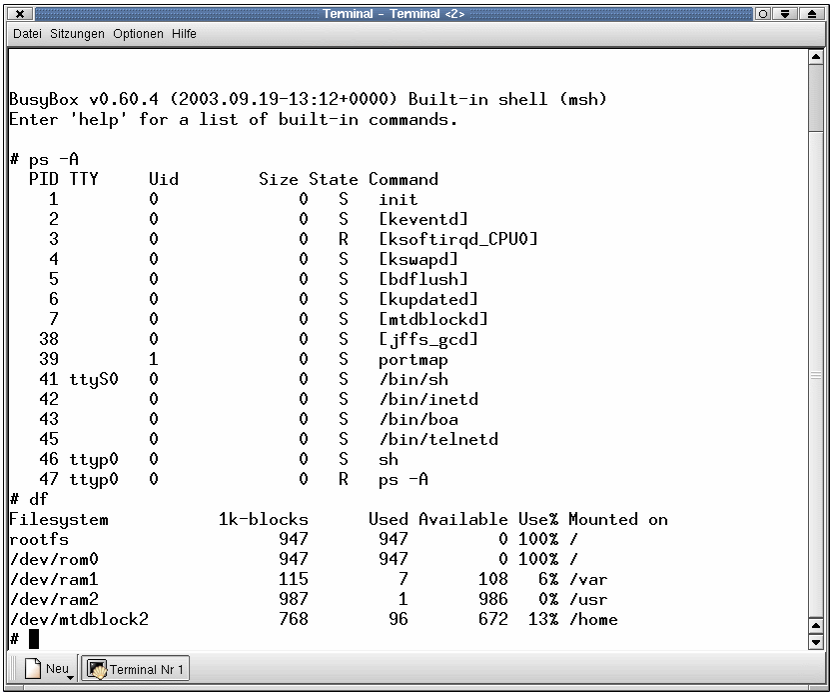


Figure 6-12: Enter Linux commands via Telnet

Note: You can enter Linux commands in different command line interfaces (CLI), i.e. a serial console (like HyperTerminal or Minicom) or a Telnet client.

6.6 Filetransfer via TFTP

The DNP/5280 inside of the IGW/900 offers a very simple way for Ethernet-based file transfers between your PC system and the DNP/5280 RAM disk drives or JFFS-based flash disk drives. This file transfer is using the TCP/IP service **TFTP (Trivial File Transfer Protocol)**.

TFTP is server/client-based. The DNP/5280 Linux configuration offers a TFTP client program. Your PC needs a TFTP server program.

Setup an Ethernet link between theIGW/900 10/100 Mbps Ethernet interface and the Ethernet interface of your PC system. Check the IP address of the PC system with the Linux command ***ifconfig***. The default IP address (factory setup) of the DNP/5280 inside of the IGW/900 is 192.168.0.126.

Now run a TFTP server program on your PC system. Most Linux-based PCs come with a pre-installed TFTP server program. Some of these systems start this TFTP server program at boot time (the TFTP server is a part of the inetd service).

In all other cases you have to edit one or more configuration files (SuSE: ***/etc/inetd.conf***). See the user documentation of your Linux distribution for details.

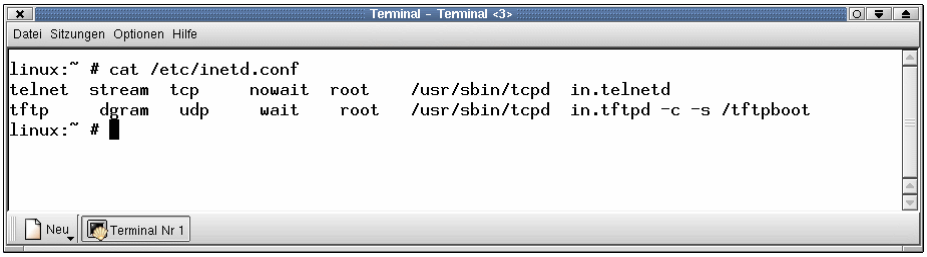


Figure 6-13: Running TFTPD32

Check the TFTP connection between the DNP/5280 and your PC system. Open a Telnet session and use the following commands for downloading and uploading files:

tftp –g –l file.name ip-addr
tftp –p –l file.name ip-addr

The command ***tftp*** is the name of the DNP/5280 TFTP client program.

The parameter ***–g*** stands for get (get a file from the PC system to the DNP/5280).

The parameter ***–p*** stands for put (put a file from the DNP/5280 to the PC system).

The parameter ***–l*** file.name specifies the file for put or get.

The parameter ***ip-addr*** stands for the IP address of your PC system (i.e. 192.168.0.1).

Most TFTP server programs work with a default directory for put and get commands. Each TFTP put command writes a file to this directory. Each TFTP get command reads the file from this directory on your PC system. Most TFTP server programs allow you to change this directory.

Example:

The following picture shows the use of the DNP/5280 TFTP client within a Telnet session.

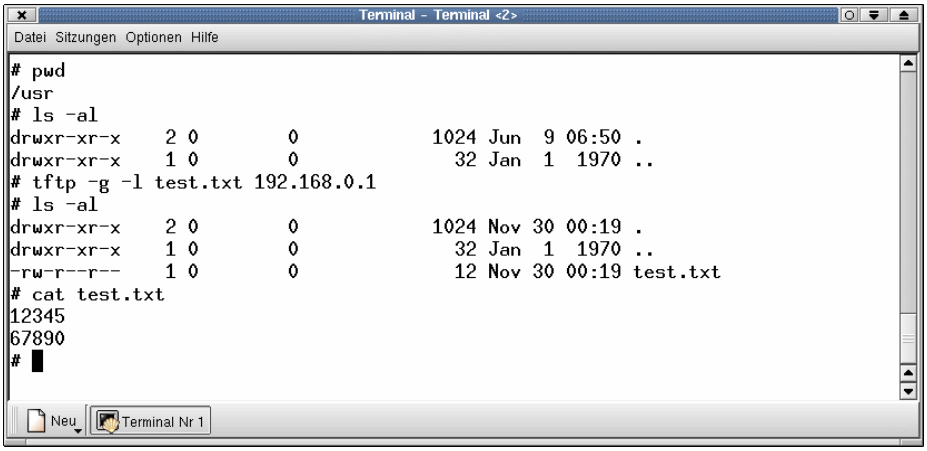


Figure 6-14: Using the DNP/5280 TFTP client within a Telnet session

Note: A file transfer to the DNP/5280 must be started with a Telnet session from RAM disk or JFFS-based flash disk directories. You need R/W access for the TFTP get command.

6.7 GNU Cross Tool Chain

This chapter describes how to install and use the Linux **GNU Cross Tool Chain** for DNP/5280 Linux C programming. You need administrator rights on your Linux PC for following these steps.

The GNU Cross Tool Chain for DNP/5280 Linux C programming comes within a Linux shell script file with the name *m68k-elf-tool-20030314.sh*. You find this file at the Starter Kit CD-ROM. The location of this 18 Mbytes shell script file is ***\µCLinux\Toolchain***.
Point your file manager to *m68k-elf-tool-20030314.sh*.

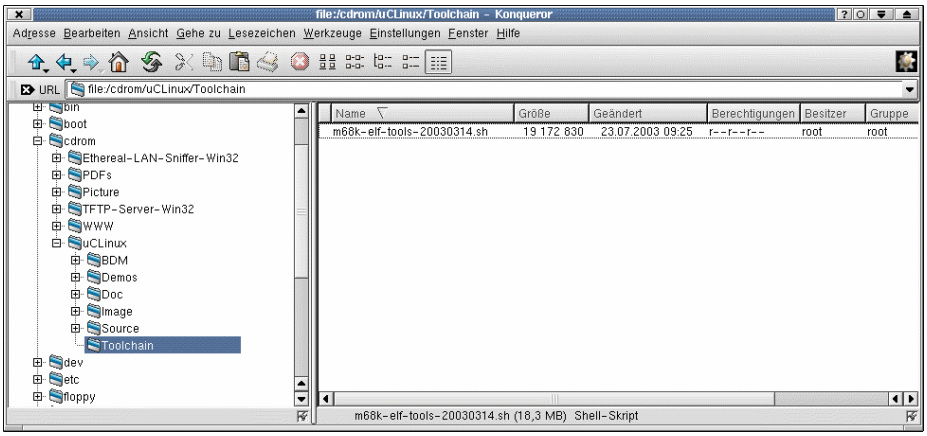


Figure 6-15: Location of m68k-elf-tool-20030314.sh at the DNP/SK14 CD-ROM

Now copy *m68k-elf-tool-20030314.sh* to your local hard disk drive. Change the file attributes to executable. For this task you can use the Linux command line:

chmod +x m68k-elf-tool-20030314.sh.

Some file managers offer simpler ways for attribute changing.

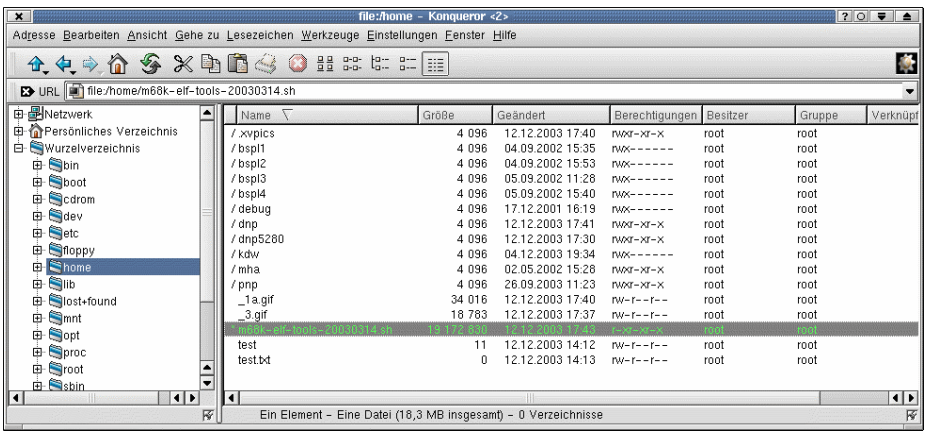


Figure 6-16: Copying m68k-elf-tool-20030314.sh to the local hard disk drive

Run the shell script file *m68k-elf-tool-20030314.sh* from a console window at your Linux-based PC. The shell script creates new directories at ***/usr/local*** and copies many files to the new directory of your PC hard disk drive.

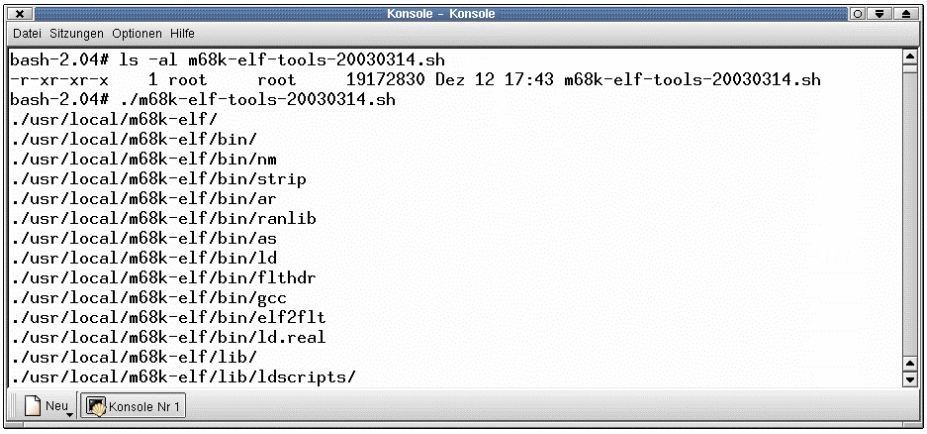


Figure 6-17: m68k-elf-tool-20030314.sh creates new directories at /usr/local

Now it is time for a test drive with the new GNU Cross Tool Chain. Open up a console window and create a new directory ***/home/dnp5280*** for DNP/5280 Linux C programming. Then change to this directory and enter the following command lines:

cat > hello.c
#include <stdio.h>
#include <stdlib.h>
void main (void)

{
printf ("Hello from DNP/5280!");
}

CONTROL + C stops the cat command and saves the input to the file *hello.c*.

These command lines create the new file *hello.c* and put some C source code lines to this new file. The command line:

cat hello.c

displays the current content of *hello.c*. For building an executable from *hello.c* please enter the following command line:

m68k-elf-gcc –Wall –m5307 –Wl,-elf2flt –Os –o hello hello.c –lc

This command line runs the GNU C cross compiler and linker. After a successful run you will find an executable for the DNP/5280 within the same directory.

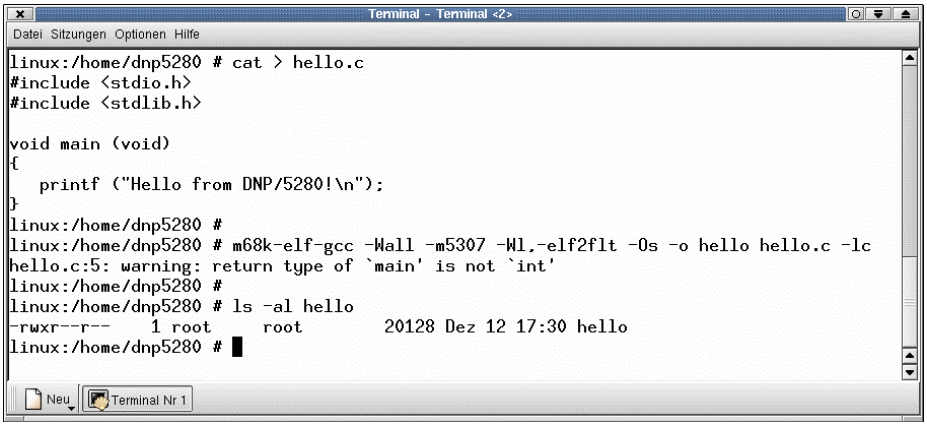


Figure 6-18: Working with the GNU Cross Tool Chain

Transfer the executable from your PC hard disk drive to the DNP/5280 RAM disk or JFFS-based flash disk drive and run the executable on your DNP/5280 inside of the IGW/900. Use a TFTP session and a Telnet session for this task. Please enter the following commands within the DNP/5280 Telnet session window:

tftp –g –l hello 192.168.0.1
chmod +x hello
./hello

The first command line transfers the executable *hello* from the PC to the DNP/5280 inside of the IGW/900. This line assumes that the PC is using the IP address 192.168.0.1.
The second line makes sure that the executable attribute is set for *hello*.
The next command line runs *hello*.

6.8 GNU Cross Debugger

The GNU Cross Tool Chain for DNP/5280 Linux C programming offers a pre-build cross version of the **GNU Debugger**, called *m68k-elf-gdb*.

This debugger runs on a Linux-based PC and allows you to debug DNP/5280 µCLinux executables with ELF layout at C source code level over a remote connection to the DNP/5280.

The cross debugger needs an Ethernet-based TCP/IP link between the PC and the DNP/5280 inside of the IGW/900. In addition the debugger needs also a remote debugging agent, called **gdbserver** for the DNP/5280. This agent is pre-installed within the DNP/5280 Linux.

Write your C program and translate the C source code with the GNU cross C compiler to an executable and a symbol file. Use the following command line with the ***–g*** parameter. This sample command line builds an executable, called *loop* from a source code file with the name *loop.c* and a file *loop.gdb* with symbol information:

m68k-elf-gcc –Wall –g –m5307 –Wl,-elf2flt –Os –o loop loop.c –lc

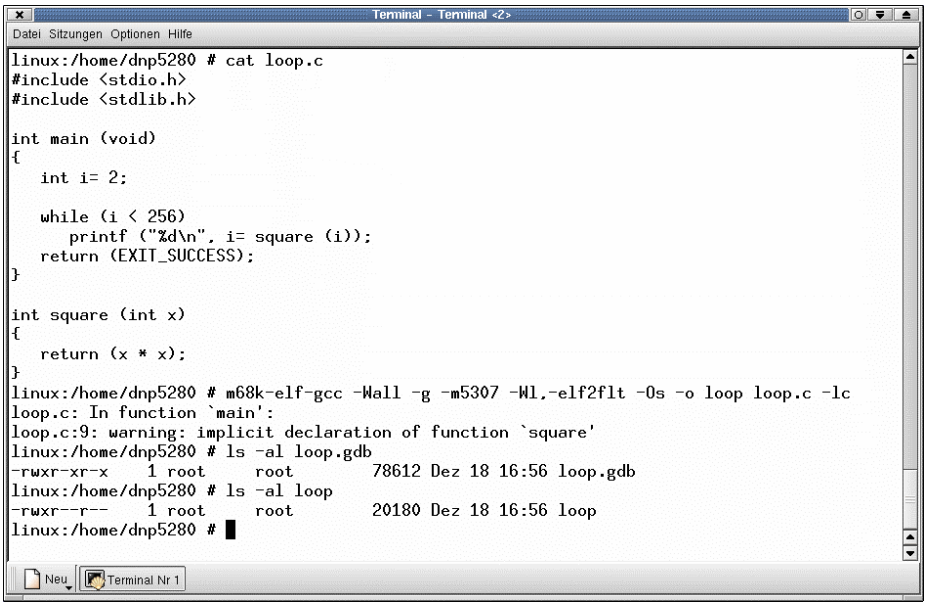


Figure 6-19: Compiling a C program with the GNU Cross Debugger

Transfer the executable from your PC hard disk drive to the DNP/5280 RAM disk or JFFS-based flash disk drive and run the executable on your DNP/5280 with the help of *gdbserver*. Use a TFTP session and a Telnet session for this task. Please enter the following command lines within the DNP/5280 Telnet session window:

tftp –g –l loop 192.168.0.1
chmod +x loop
gdbserver 192.168.0.1:2222 ./loop

The first command line transfers the executable *loop* from the PC to the DNP/5280 inside of the IGW/900. This line assumes that your PC is using the IP address 192.168.0.1.
The second line makes sure that the executable attribute is set for *hello*.
The third command line runs *loop* with the help of *gdbserver*. Within this command line you need the IP address of the PC together with a TCP/IP port number. We use the port number 2222 for this sample.

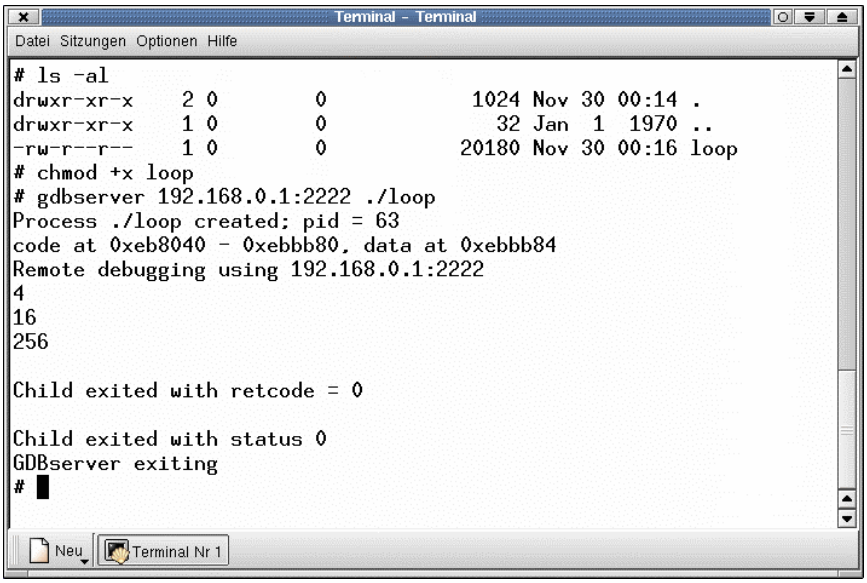


Figure 6-20: File transfer and execution

Run the GNU Cross Debugger *m68k-elf-gdb* on your PC. Use the following command line. The parameter *loop.gdb* is the file name for the symbol information file.

m68k-elf-gdb loop.gdb

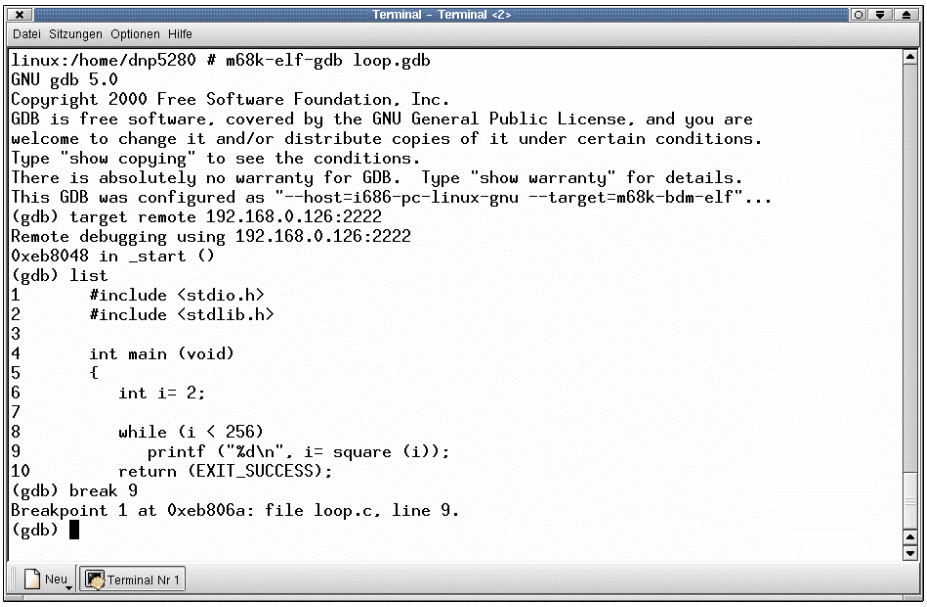


Figure 6-21: The GNU Cross Debugger at work

Now the debugger waits for your debugging commands. First please enter always the following command line:

target remote 192.168.0.126:2222

This debugger command line sets up the Ethernet-based TCP/IP connection between the PC and the DNP/5280 inside of the IGW/900. Please use the same TCP/IP port number (2222). The sample command line assumes that the DNP/5280 uses the IP address 192.168.0.126.

Then set your breakpoints within the C source code and run your program with the remote debugging session between the PC and the DNP/5280 inside of the IGW/900.

Use the debugger command ***continue*** for running the program. The program runs to the next breakpoint. The short form for this command is ***cont***.

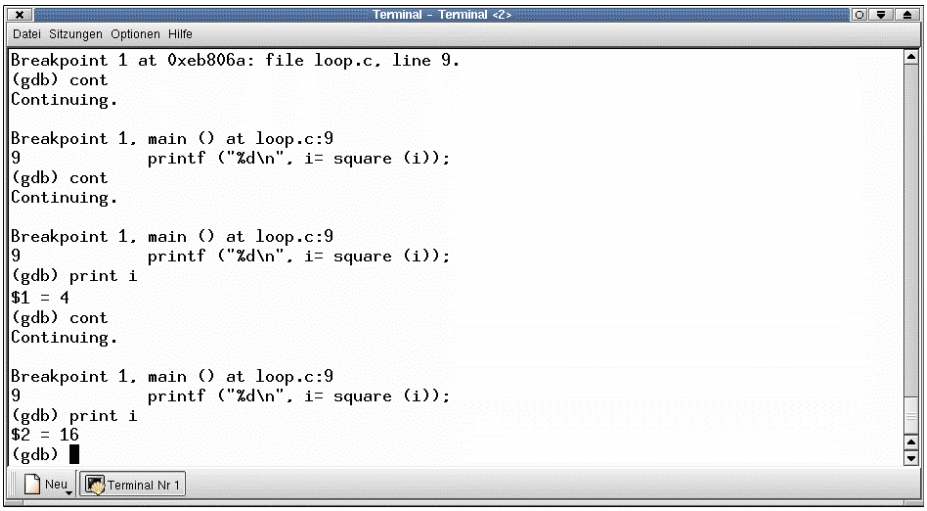


Figure 6-22: Setting breakpoints

6.9 GNU Cross Debugger with DDD (Data Display Debugger)

The GNU Cross Tool Chain for DNP/5280 Linux C programming offers a pre-build cross version of the GNU Debugger, called *m68k-elf-gdb*. This debugger runs on a Linux-based PC and allows you to debug DNP/5280 µCLinux executables with ELF layout at C source code level over a remote connection to the DNP/5280.

The cross debugger needs an Ethernet-based TCP/IP link between the PC and the DNP/5280 inside of the IGW/900. In addition the debugger needs also a remote debugging agent, called *gdbserver* for the DNP/5280. This agent is pre-installed within the DNP/5280 Linux.

The GNU debugger offers a simple command line interface and a lot of different commands. With the help of **DDD (Data Display Debugger** - a graphical front-end for command line debuggers) you get a powerful graphical user interface for the GNU debugger. DDD is a part of many PC Linux distributions.

DDD is also available from *http://www.gnu.org/software/ddd/*.

Write your C program and translate the C source code with the GNU cross C compiler to an executable and a symbol file. Use the following command line with the ***–g*** parameter. This sample command line builds an executable, called *loop* from a source code file with the name *loop.c* and a file *loop.gdb* with symbol information.

m68k-elf-gcc –Wall –g –m5307 –Wl,-elf2flt –Os –o loop loop.c –lc

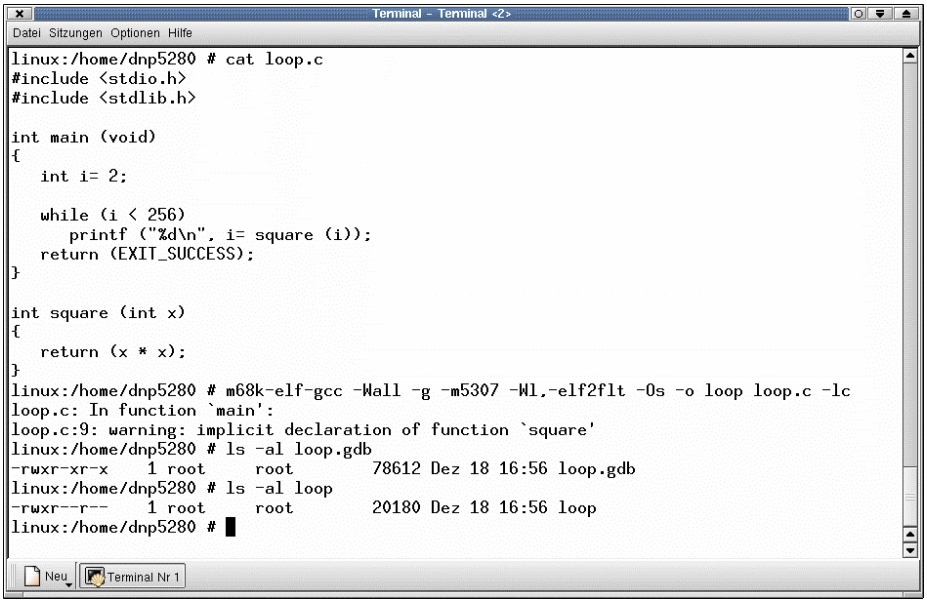


Figure 6-23: Compiling a C program

Then transfer the executable from your PC hard disk drive to the DNP/5280 RAM disk or JFFS-based flash disk drive and run the executable on your DNP/5280 with the help of *gdbserver*. Use a TFTP session and a Telnet session for this task. Please enter the commands on the next page within the DNP/5280 Telnet session window:

tftp –g –l loop 192.168.0.1
chmod +x loop
gdbserver 192.168.0.1:2222 ./loop

The first command line transfers the executable *loop* from the PC to the DNP/5280 inside of the IGW/900. This line assumes that your PC uses the IP address 192.168.0.1. The second line makes sure that the executable attribute is set for *hello*. The third command line runs *loop* with the help of *gdbserver*. Within this command line you need the IP address of the PC together with a TCP/IP port number. We use the port number 2222 for this sample.

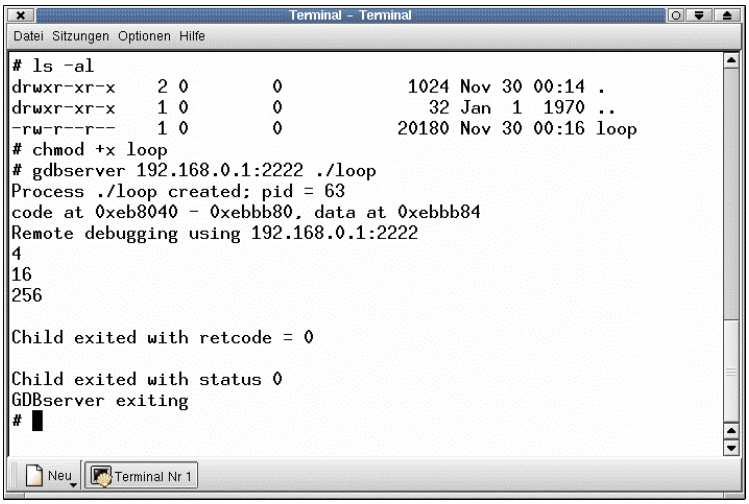


Figure 6-24: File transfer and execution

Run the GNU Cross Debugger *m68k-elf-gdb* with the help of DDD on your PC. Use the following command line. The parameter ***--debugger m68k-elf-gdb*** tells DDD the name of the debugger, *loop.gdb* is the file name for the symbol information file.

ddd –-debugger m68k-elf-gdb loop.gdb

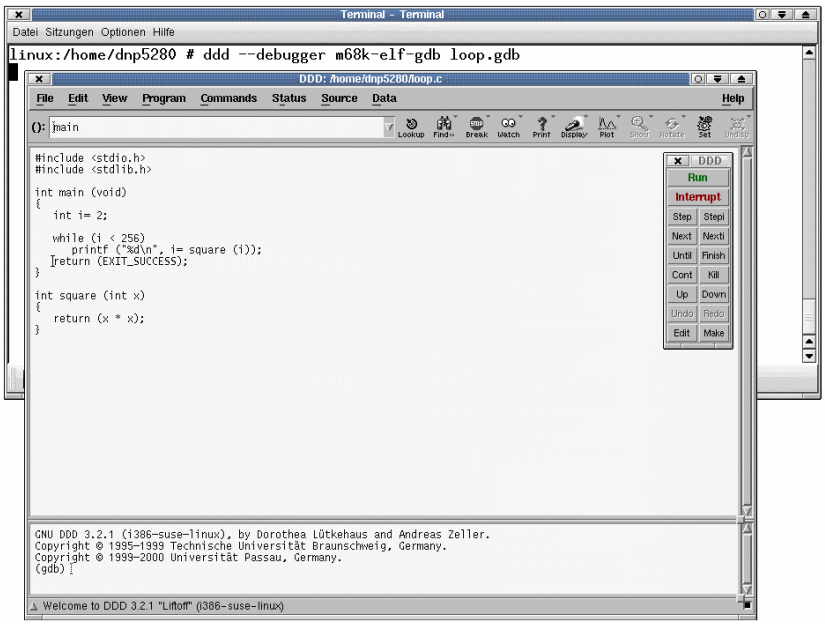


Figure 6-25: Working with the DDD

Now the debugger waits for your debugging commands. First please enter always the following command line within the DDD command line window:

target remote 192.168.0.126:2222

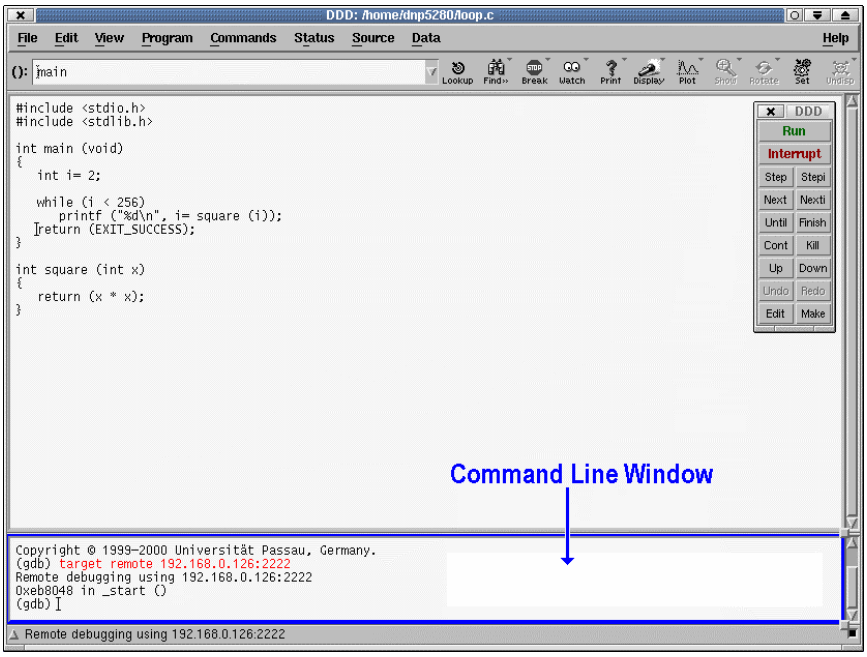


Figure 6-26: Typing commands in the command line window

This debugger command line sets up the Ethernet-based TCP/IP connection between the PC and the DNP/5280 inside of the IGW/900. Please use the same TCP/IP port number (2222). The sample command line assumes that the DNP/5280 uses the IP address 192.168.0.126.

Then set your breakpoints within the C source code and run your program with your remote debugging session between the PC and the DNP/5280.

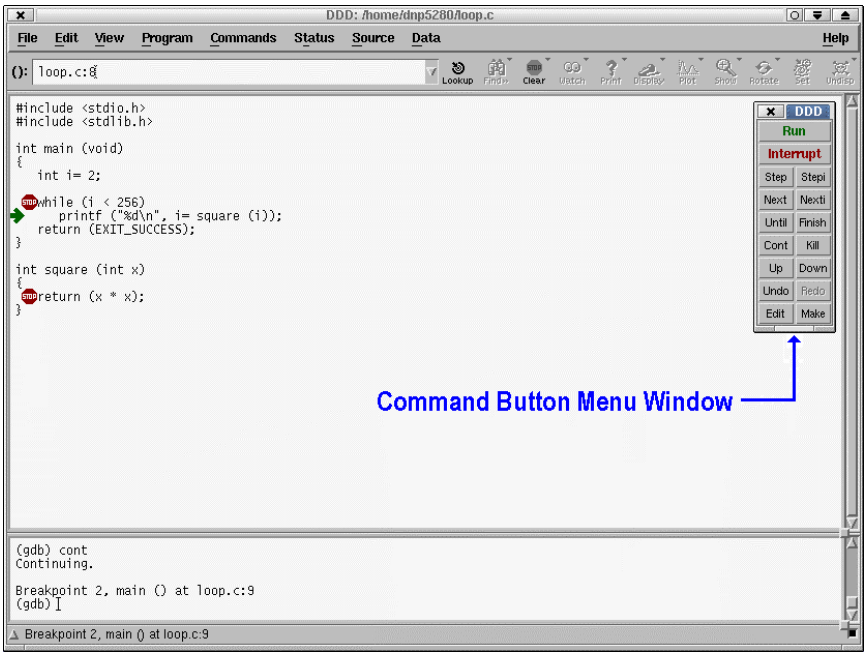


Figure 6-27: Using the command button menu window

DDD allows you to set breakpoints with your mouse. Just put the mouse cursor over the source code line of your choice and press the right hand mouse button. Then use the command button for

continue

from the command button menu window for running the program. The program runs to the next (or first) breakpoint. You can also use the command button

step

for single-stepping at C language level through your program. If the program execution stops, you can enter debugger commands within the DDD command line window. For example

show version

The GNU Debugger shows then some copyright and version information and the current configuration (Build for Host *i686-pc-linux-gnu*. Build for Target *m68k-bdm-elf*).

APPENDIX 1: BLOCK DIAGRAM

The next figure shows the schematic diagram of the IGW/900. The basis forms a DIL/NetPC DNP/5280 with Motorola Coldfire MCU MCF5280 and a clock rate of 66 MHz. The IGW/900 needs a 12-24 VDC supply. To provide the DNP/5280 inside the IGW/900 with the necessary voltage of 3.3V there is an internal transformator inside of the IGW/900. The connection of the serial interfaces COM1 (RS232) and COM2 (RS485) to the DNP/5280 are made via internal level shifters. For the connection with Ethernet networks there is a 10/100 Mbps interface present, which automatically detect the correct data rate. To check the current system status the IGW/900 is equipped with four LED indicators that signal the providing with power as well as the actual status of the three free programmable ports.

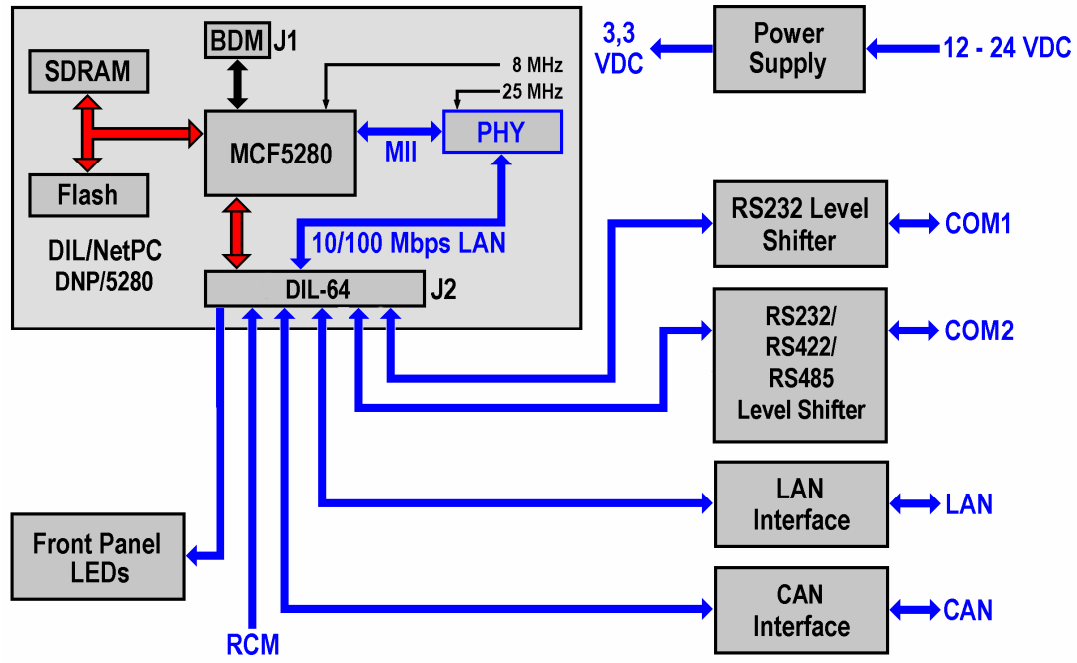


Figure A1-1: Block diagram of the IGW/900

APPENDIX 2: MECHANICAL DIMENSIONS

The IGW/900 has a size of 117 x 22.5 x 90 mm (L x W x H). These dimensions are shown in the figure below. On the backside of the IGW/900 there is a 35 mm DIN rail mounting unit.

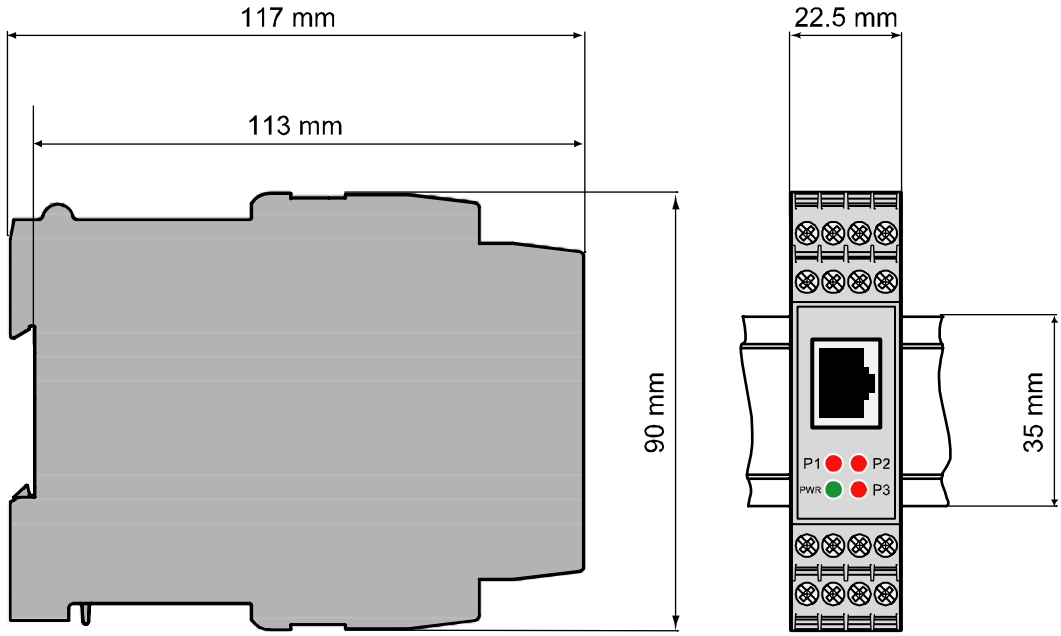
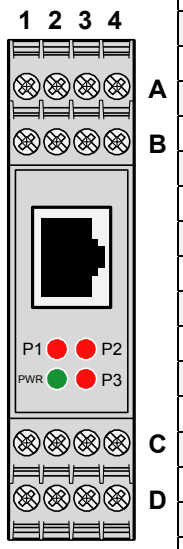


Figure A2-1: Mechanical dimensions of the IGW/900

APPENDIX 3: PINOUT IGW/900

The table A3-1 shows the assignment of the IGW/900 screw terminal.



		CAN	COM1	COM2			Power	RCM
			RS232	RS232	RS422	RS485		
A	A1						V+ IN	
	A2						GND IN	
	A3	CAN L						
B	A4	CAN H						
	B1		RTS					
	B2		TXD					
	B3		RXD					
	B4		CTS					
	C1		Sig. GND	Sig. GND	Sig. GND	Sig. GND		RCM
	C2			RXD				
	C3			TXD				
	C4							RCM
C	D1				RX+	RX/TX+		
	D2				TX+			
D	D3				RX-	RX/TX-		
	D4				TX-			

= Cable bridge

Table A3-1: Pinout of the IGW/900

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.
5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a “work that uses the Library”. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a “work that uses the Library” with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a “work that uses the library”. The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a “work that uses the Library” uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable “work that uses the Library”, as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user’s computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

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Yoyodyne, Inc., hereby disclaims all copyright interest in the library `Frob’ (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

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ColdFire Programmers Reference Manual R.1.0 (MCF5200PRM/AD)

MCF5280 ColdFire Microcontroller User's Manual R.0.1 (MCF5280UM/D)

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