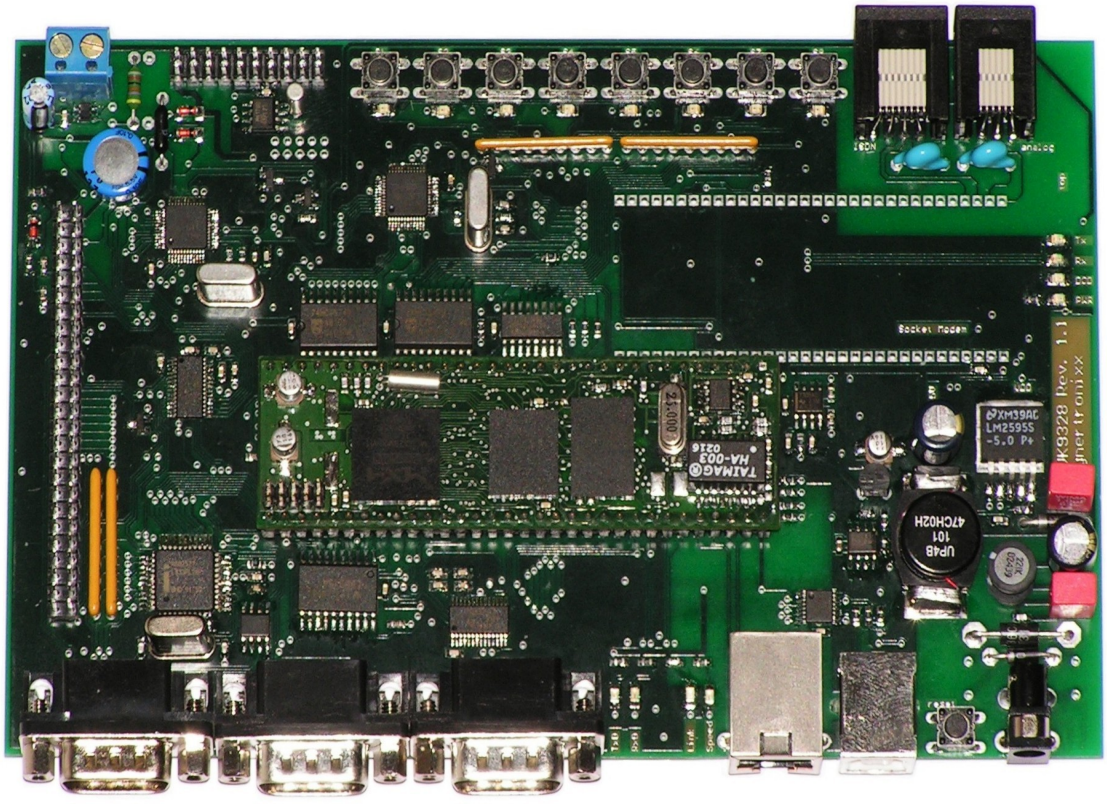
EVB9328 Professional
Getting Started



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1 Introduction

This document provides a step by step guide on how to put an embedded socket computer SCB9328 into operation. Although some knowledge about LINUX and IP networking is advised, an introduction into IP Networking is also provided in this document. This document concentrates on the use of the software integrated into the SCB9328 and less on the hardware. Throughout this manual, the evaluation board EVB9328 Professional is used.

The SCB9328 is a complete system on chip that enables the design enineer to implement complex hard- and software designs in their own products. It is designed as a microcontroller drop-in replacement and contains the microprocessor core, the ethernet controller, all necessary memory components, the power management and the glue logic. The SCB9328 implements a full embedded computer system with a preinstalled bootloader and a fully featured LINUX 2.6.5 on a very small standard JEDEC DIL-64 (27 x 84mm) module. It can be used in a wide variety of applications that require remote control and monitoring via the ethernet are most suitable for the SCB9328 since control and monitoring can be done through the use of a standard Web browser such as Internet Explorer, Netscape Mozilla or Konqueror.

The Starter Kit provides all required basic hard- and software environment, allow you developing individual applications for the SCB9328. The base component of the Starter Kit is the EVB9328 Professional Evaluation Board. On this board you will find a DIL-64 socket (DIL = Dual In Line) to mount your SCB9328. The main features of the EVB9328 Professional Evaluation Board are:

- DIL-64 Socket for one SCB9328
- Two serial RS232 interfaces
- 10/100Mbit ethernet interface
- High-speed CAN-Bus (up to 1Mbit/s)
- Precision 16-bit ADC with 10V DC input
- Gold-cap buffered realtime clock

- Eight free programmable LEDs
- Eight push button switches
- 5V external bus interface
- A switching DC/DC converter (8 ... 30V input)
- One Reset Switch

Not only the hardware is supplied to you with features such as ethernet, serial port and programmable I/O pins, the software to use these interfaces is already implemented in the SCB9328. The main important features included in the synertronixx LINUX distribution are:

- Embedded Linux 2.6.20
- Bootloader uboot 1.2.0
- A full TCP-IP stack with application interfaces for UDP and TCP sockets.
- DHCP client.
- FTP server.
- SSH/Telnet server
- A web server (HTTP) capable of CGI
- Driver support for UART, I^2C and GPIO
- Journaling flash file driver JFFS2 for the internal flashdiskdrive

2 EVB9328 Getting Started

Before you start, please check the starter kit to ensure all components are present. The EVB9328 Professional starter kit contains:

- A EVB9328 Evaluation Board
- 12V DC power supply
- Ethernet CAT5 1:1 patch cable
- PC COM port serial cable (null-modem)
- CD-ROM containing original sources with synertronixx modifications with ARM9 cross toolchain and documentation

The following is required for the EVB9328 Professional evaluation board:

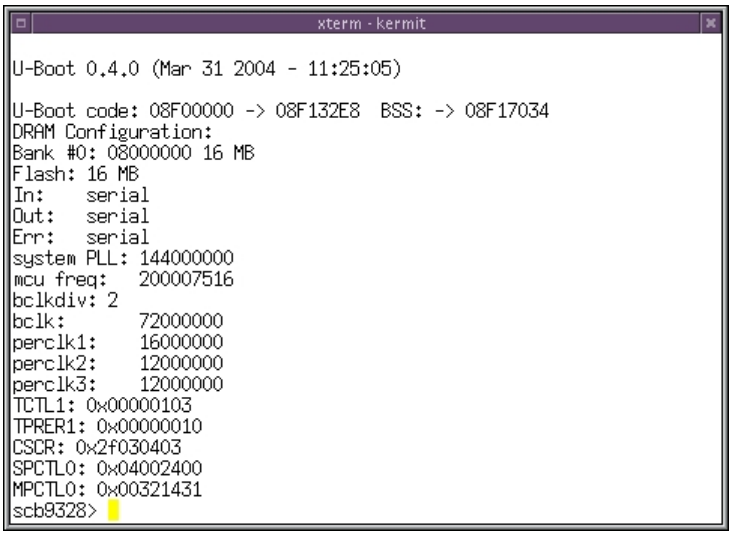
- A SCB9328 (not provided in the EVB9328 Professional evaluation board!)
- A PC running LINUX, connected to your ethernet network. If you have not running LINUX on your PC you have to install a complete LINUX distribution (for example SuSE or debian) to put the synertronixx toolchain onto it.
- An ethernet network with an available twisted pair connection for the EVB9328
- A free PC serial port
- A terminal program like kermit or similar
- A FTP and Telnet/ssh client

Setting up the evaluation board is simply a matter of connecting it to your PC and supplying power it on.

1. Connect the null-modem serial cable to a free serial port of your PC
2. Start your terminal program on your PC. The settings are 115,2 kBaud, 8 databits, 1 stopbit, no parity, no RTS/CTS, no XON/XOFF. Make sure the the terminal program has the correct settings and that it is connected to the desired serial port
3. Connect the power supply (12V DC) to the EVB9328 and switch it on.
4. At power on, the green Power-On LED will turn on immedeately. If the Power-On LED does not light up please check your connection the power supply. Some of the free programmable yellow LEDs may light up, the startup state of these LEDs is undefined.
5. Turn power off.
6. To mount the SCB9328 on the evaluation board set it carefully on the DIL-64 interface onto the evaluation board. Please note, that the SCB9328 is positioned in the right way. The transformer on the top of the SCB9328 must show close to the RJ45 ethernet connector. After that, push the SCB9328 down, so that the DIL-64 socket fixes it. Please also refer to the picture xxx. When inserting the SCB9328 in the wrong direction it may be damaged!
7. When turn power on again, the green Power-On LED must light up. If the Power-On LED does not turn on switch off your evaluation board immediately! Please check the correct placement of the SCB9328 in the DIL

socket.

After successful power up you will see on the terminal window below the output from the startup procedure:

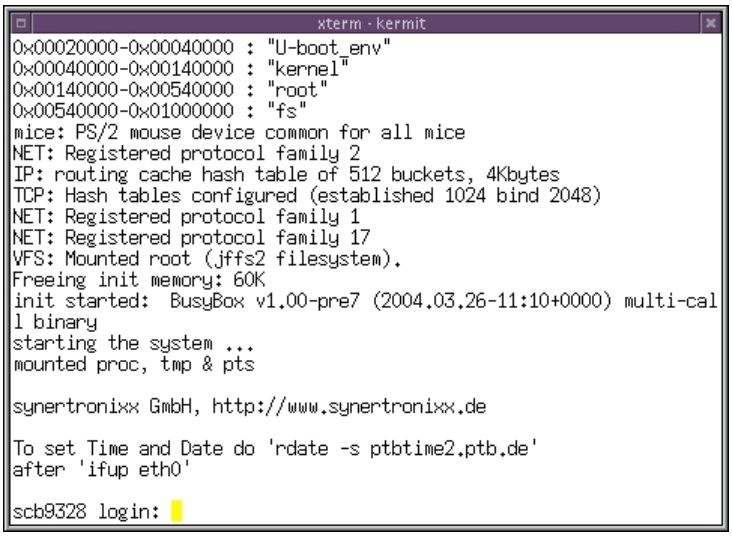


The bootloader initialises the MC9328MXL CPU, setting up the system and CPU PLL and shows the setting of the most important CPU registers. If you see not the message from the startup procedure, please make sure that

- you use an 1:1 serial cable and that it is installed correctly to your EVB9328 Professional evaluation board and the PC. Make shure that you have choosen the right RS232 connector on your evaluation board.
- the terminal program has the correct settings and that you are not using the wrong PC serial port.
- you have installed the SCB9328 correctly in the DIL-64 socket in the evaluation board.

3 Starting Linux

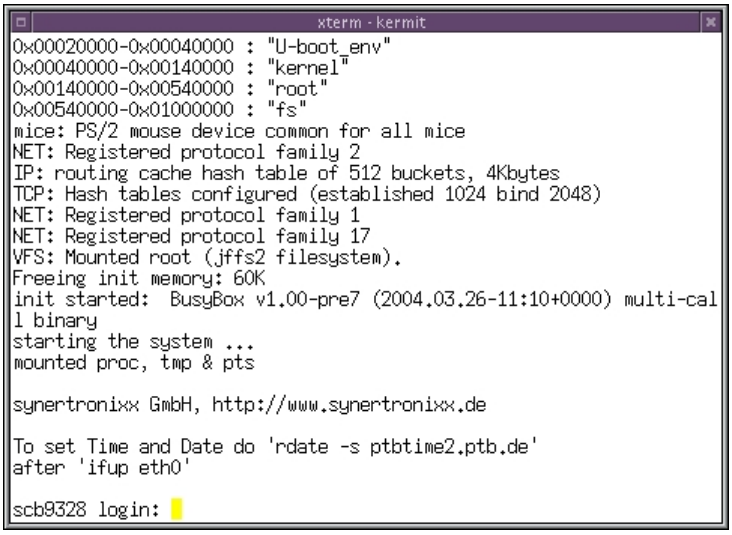
When you see the startup message from the bootloader, starting LINUX is very simple. Just type “boot“ at the `scb9328>` promt and LINUX will starting. The boot messages are displayed over the internal serial SCB9328 interface. After some seconds you'll see the following message in the terminal window:



At the login prompt login with the following default username and password:

```
scb9328 login:    root
password:         pass
```

Its important that you type in the login name and password in lower letters. The password itself is not displayed in the terminal window. After logging in you see the following LINUX prompt:



Congratulation! You've succesfully started LINUX on your embedded socket computer SCB9328. You are ready now to setup your LINUX system.

4 Network Configuration

4.1 Some generic network knowledge

The Internet Protocol (IP) provides for transmitting blocks of data from source to destinations, where sources and destinations are hosts identified by fixed-length adresses. It uses a 32-bit adressing scheme. Each host participating in a TCP/IP network is identified via a 32-bit IP address and must be unique. An intelligent ‘trick’ of the IP address is that it not only identifies the device, it also tell us where to find the device in a large network. This is best explained by an example: Suppose we have the address 192.168.1.123 and the netmask 255.255.255.0. Let us look at these data in a ‘binary’ format:

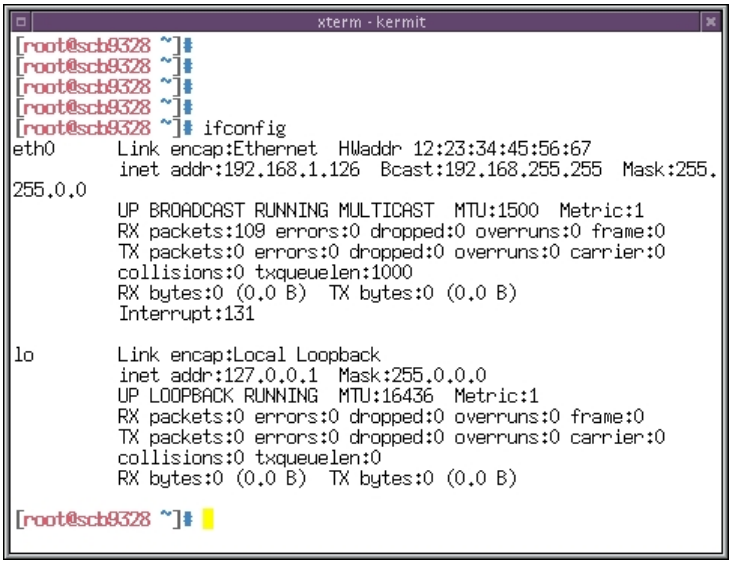
	IP decimal	IP binary
Address	192.168.1.123	11000000.10101000.00000000.01111011
Netmask	255.255.255.0	11111111.11111111.11111111.00000000
Logical “AND“		11000000.10101000.00000000.00000000

The first 24 bits of the network mask are ‘1’. This means that the first 24 bits of the address identify the network. The last 8 bits (those that are ‘0’ in the network mask) identify the device within this network. This would mean that in the given example, that we can give the devices in our network the addresses 192.168.1.0 through 192.168.1.255, thus allowing for 256 devices. This is almost correct, but not 100%. The lowest (here 192.168.1.0) and the highest address (here 192.168.1.255) may not be used. Thus limiting us to 254 devices on this network. This we call a ‘Class C’ network. The highest address (here 192.168.1.255) has a special meaning: this is the address used for a broadcast to all devices on this section of the network. Any message send to this address is received by all devices. An address that does not match the range of the current network, is passed to the gateway.

4.2 Network settings for SCB9328

First of all you have to configure your network interface of the SCB9328. Insert the network patch cable to the RJ45 ethernet connector of EVB9328 and a free port of a hub or switch. The SCB9328 supports 10Mbit ethernet als well as 100Mbit fast ethernet networks. For best performance use a 100Mbit fast ethernet hub or switch.

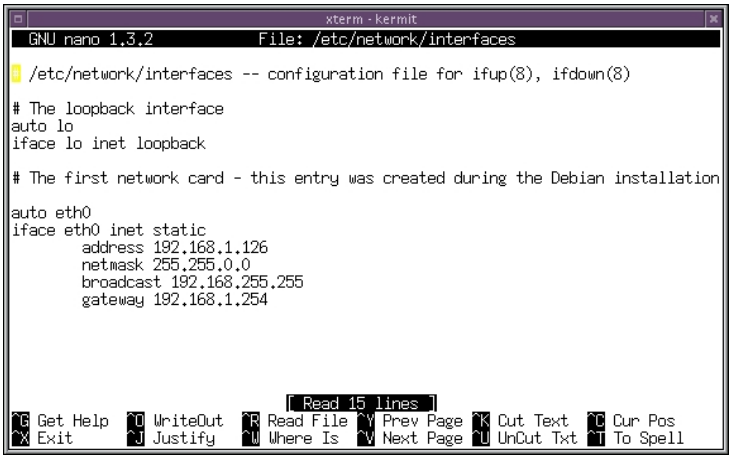
The SCB9328 is preconfigured with the IP address 192.168.1.199. Probably this will not match your network settings. If you are not sure which addresses you are allowed to use in your network please ask your local network administrator. To see the current network setting on your SCB9328 type ifconfig on the console:



In the second line you can see the IP address and the netmask. If your IP address is 129.144.52.38 for example you must change the associated network configuration file. This configuration file is a plain textfile and can be found in the directory /etc/network. On the console type

```
cd /etc/network
nano interfaces
```

You should see the following screen:

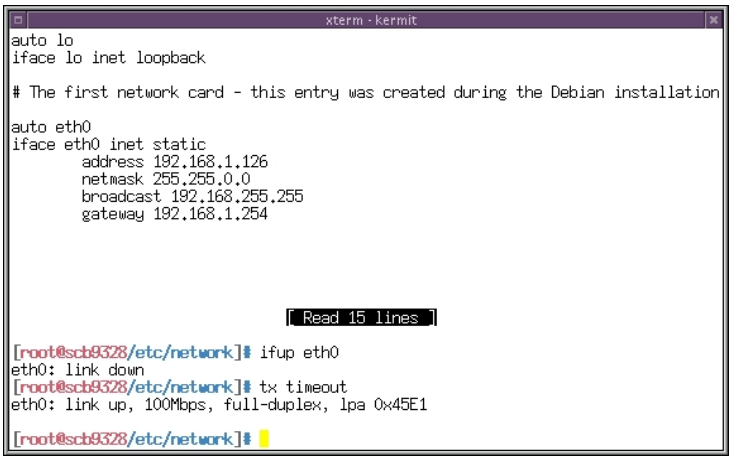


Please change the IP address to your desired value i.e. 129.144.52.32 in our example and store the settings by simply leaving the editor with Ctrl+X. The editor will ask if the edited file should be saved so type Enter and again when it asks for the file to write. Most used commands are described how to invoke on the last two lines of the editor.

After customizing the interface settings make them active by typing

```
cd /
ifup eth0
```

on the console and the ethernet interface adapter on the SCB9328 should be initialised. Your screen should show something like this:



The yellow LinkLED close to the RJ45 ethernet connector will light up and show, that the ethernet link is enabled. Depending on your network infrastructure, the green SpeedLED will indicate if you are connected to a standard (SpeedLED is off) or a 100Mbit fast ethernet network (Speed is on). The SpeedLED also indicates the traffic on the network by flashing up.

Next you should confirm that your network settings are correct. In order to obtain this we have to send some data to the SCB9328 and echo it back to the PC. This will be done by the ping command. Open a second console and type

```
ping -c 4 [IP-address]
```

where IP-address is the configured IP-address from the SCB9328.

Example:

```
ping -c 4 192.168.1.13
```

On the console window you will see something similar like the following:

```
xterm - kermit
[root@scb9328/etc/network]# ping -c 4 192.168.1.13
PING 192.168.1.13 (192.168.1.13): 56 data bytes
64 bytes from 192.168.1.13: icmp_seq=0 ttl=64 time=0.5 ms
64 bytes from 192.168.1.13: icmp_seq=1 ttl=64 time=0.4 ms
64 bytes from 192.168.1.13: icmp_seq=2 ttl=64 time=0.4 ms
64 bytes from 192.168.1.13: icmp_seq=3 ttl=64 time=0.4 ms

--- 192.168.1.13 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 0.4/0.4/0.5 ms
[root@scb9328/etc/network]#
```

Because we will need a FTP file transport later, we now start our FTP daemon with

```
proftpd
```

In the same manner we also start the Telnet daemon with

```
telnetd
```

After that you should verify if the daemons are running by typing

```
ps xa
```

and the daemons should appear in the process list:

```
xterm - kermit
[root@scb9328/usr/lib]# ps xa
  PID  Uid     VmSize Stat Command
    1 root        328 S    init
    2 root            SWN [ksoftirqd/0]
    3 root            SW< [events/0]
    4 root            SW< [kblockd/0]
    5 root            SW  [pdflush]
    6 root            SW  [pdflush]
    7 root            SW  [kswapd0]
    8 root            SW< [aio/0]
    9 root            SW  [mtdblockd]
   10 root            SWN [jffs2_gcd_mtd3]
   28 root        444 S    -sh
   61 root        252 S    telnetd
   63 root        412 S    betaftpd
   70 root        300 R    ps xa
[root@scb9328/usr/lib]#
```

4.3 Wireless LAN settings for SCB9324

The SCB9324 version of the socket computers comes with an additional wireless LAN adapter. A driver module must be loaded to enable the device.

This is done by

```
modprobe ga_linuxdrv_211_imx_sdio
```

After executing the above command you have to wait some seconds till the device is initialized. Then run

```
ifconfig eth1 192.168.1.200
```

to configure the wireless LAN adapter with the given IP address. Note that you can configure the wlan device eth1 in the network configuration file exactly the same way the ethernet device eth0 is configured and start it with

```
ifup eth1
```

Finally you have to do some wireless settings. You may want to configure wlan with WPA2 encryption. This is done with wpasupplicant. Type

```
wpa_supplicant -Dphilips -ieth1 -c/etc/wpasupplicant.cfg -B > /dev/null
```

Of course your Access Point (AP) has to be configured correctly. If you are using a MAC filter add the MAC address of the wireless LAN adapter (HWaddr field in the output of ifconfig command). The SSID=ssid and the Password=password for WPA2 encryption are preconfigured in the configuration file

```
/etc/wpasupplicant.cfg
```

Further information of how to configure wlan, wpa_supplicant and the configuration file is given by appropriate literature regarding this topic.

5 Board Support Package

The Board Support Package is integrated into the preinstalled Linux Distribution of the scb9328 Module.

To get access to the external UARTS simply type

```
modprobe 8250
```

to load the appropriate kernel module. After that the devices /dev/ttyS0 and /dev/ttyS1 (socket modem port) are accessable.

To run a getty add the line

```
ttyS0::respawn:/sbin/getty -L ttyS0 115200 vt100
```

to the file

```
/etc/inittab
```

or start a getty by hand.

To get access to the LEDs and pushbuttons look into the evk9328leds directory provided with the synertronixx CD and read the kernel.pdf file.

In general there are some start scripts to enable support for WLAN, UARTS, LEDS and so on in the directory

```
/etc/init.d
```

6 Compiling Programs

Many LINUX program examples for the SCB9328 are available with C-source on the CD-ROM. The following example of a simple ”hello world” program can be compiled with the cross toolchain from the EVB9328 CD of your evaluation kit.

```
#include <stdio.h>
int main () {
      printf("Hallo\n");
}
```

Because the ARM9 CPU and a PC are using completely different hardware architectures we need a cross compiler for the SCB9328. synertronixx has bundled a complete software environment on the synertronixx CD, ready to use.

To make the execution of the first self created binary more easy, the scb9328 default installation offers an ftp server which guide you to the right directory,

where the binaries are easy to execute on the target.

To create a binary which can be executed on the target computer an installation of a crosstoolchain is required. This toolchain generates executable programs for the arm platform on your x86 PC. On the PC log in as superuser with `su` and type in your superuser password. The synertronixx software CD contains a file called gcc-3.3.3-uclibc-0.9.26.tar.bz2 in the directory /home/software. On the host PC mount the CD and change to the root directory. Then extract the tar.bz2 file.

```
mount /mnt/cdrom
cd /
tar xjf /mnt/cdrom/home/software/gcc-3.3.3-uclibc-0.9.26.tar.bz2
```

The archive creates a directory structure in /usr/local/arm with the required programs to crosscompile software for the scb9328 board. You need to add them to your executable search path, to make the program arm-linux-gcc available to your shell.

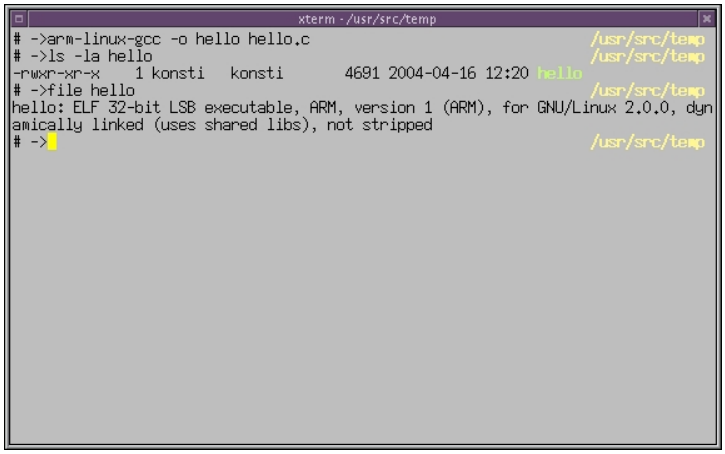
```
export PATH=/usr/local/arm/gcc-3.3.3-uclibc-0.9.26/bin:$PATH
```

Now your current shell knows the place of the binaries. To make this setting permanent and available to all users, add the line to the bottom of the /etc/profile file on your host PC. Every user logging in after that has the path of the required binaries in his path then.

An example hello world c source file is also provided on the synertronixx CD in the directory /home/software. Copy it to your host PC (into your home directory for example) and cross compile it with the command:

```
arm-linux-gcc -o hello hello.c
```

You will find a binary called hello in your current working directory.



The file command explains that the hello binary is for the arm architecture.

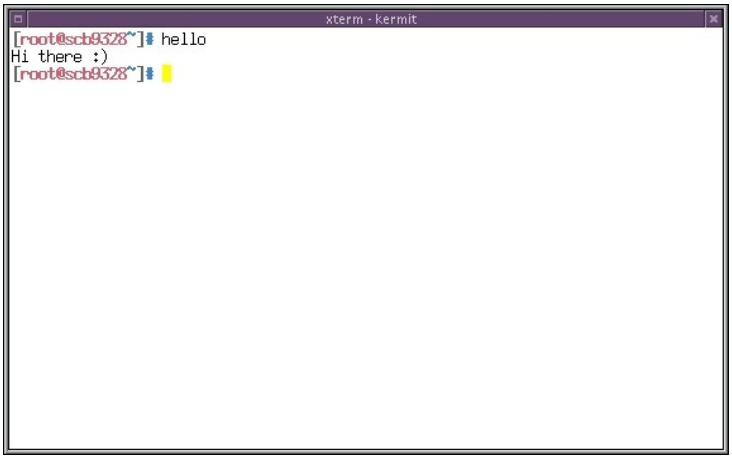
After succesfull compiling the hello.c program you have to copy the hello image file to the SCB9328. To perform this the binary is transfered by FTP. On the PC start a FTP client. Connect to the SCB9328 with the configured IP address and as the user „binary“. The password is also „binary“.

After logging in copy the file hello to the current working directory, which is /usr/local/bin by default.

On the console of your SCB9328 you can now start your hello world program. You can simply start your program by typing the folloeing command:

```
./hello
```

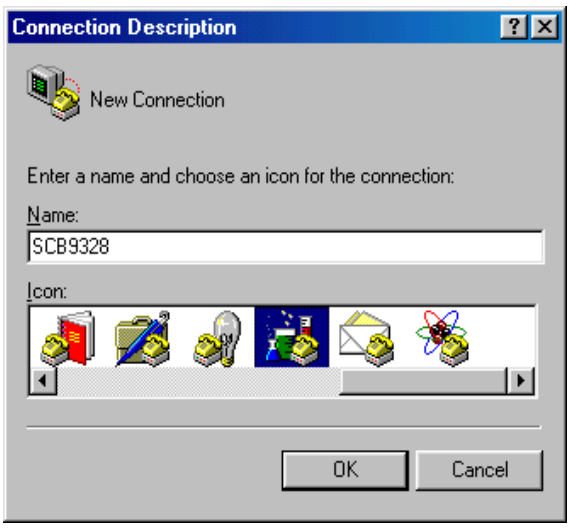
On the console window you should see the following:



Additionally you can start the “hello world“ program also over the ethernet. This can be done by opening a telnet client and connect it to the SCB9328. Login to the SCB9328 with the desired IP-address.

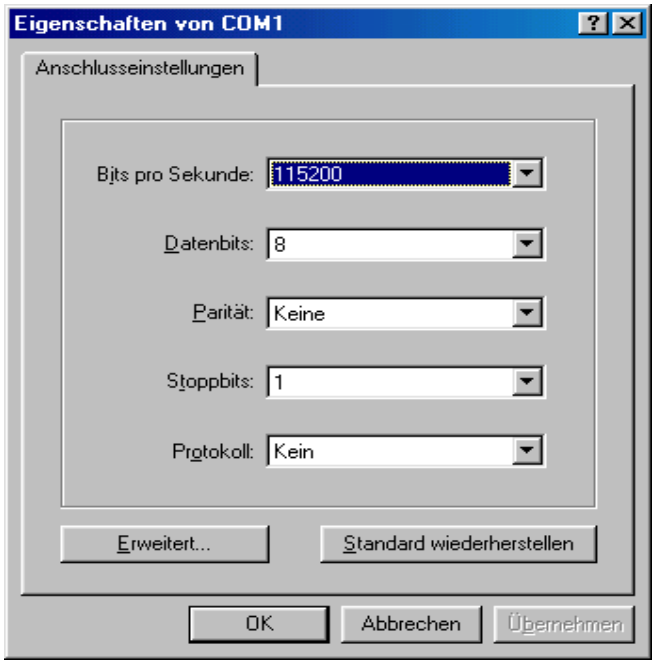
7 Using Windows

Any communication between the SCB9328 and the PC can also be performed by using Windows. Please start HyperTerminal. When the Connection Description window appears type in as name SCB9328 and choose yor desired icon for this connection . Please press the OK-Button.

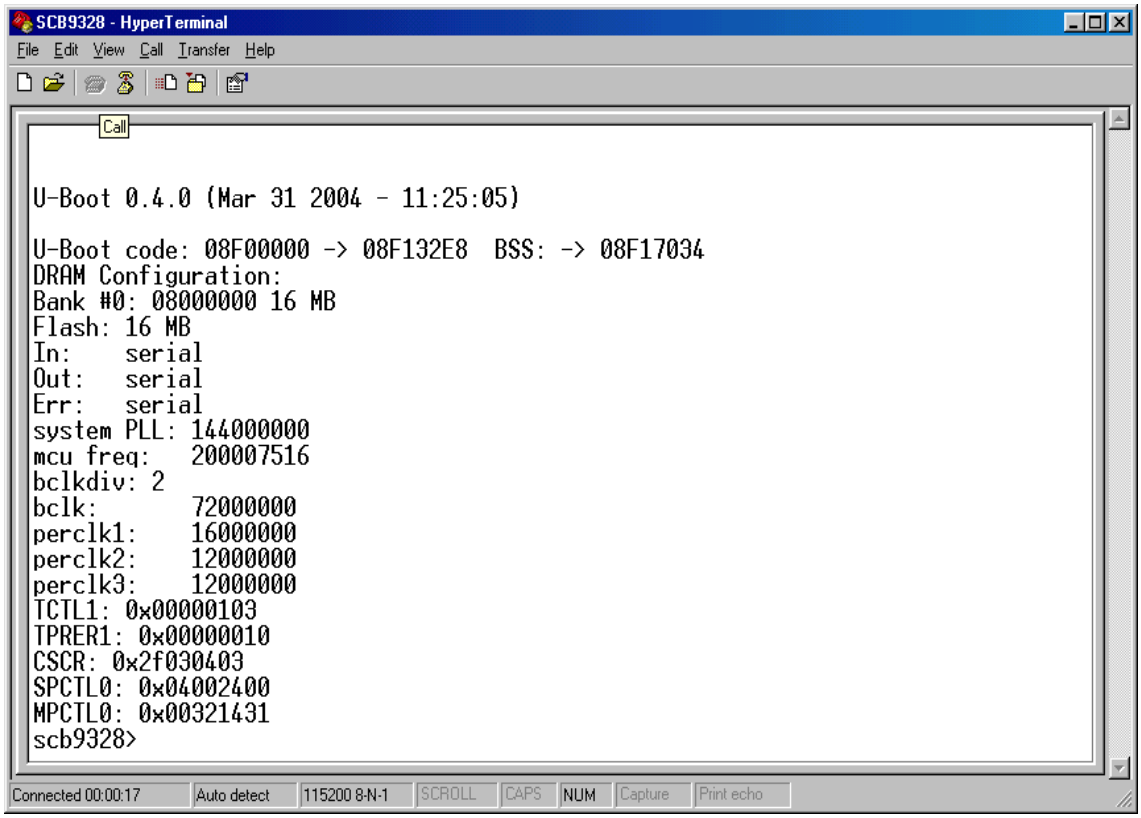


In the “Connect To” Window choose under “Connect using” the “Direct To Com1” (or a free Com port on your Computer” setting. Press the OK-Button.

Next you have to choose the communication settings of the Com port. The settings are 115,2 kBaud, 8 databits, 1 stopbit, no parity, protocol none. You should see a window similar like this:



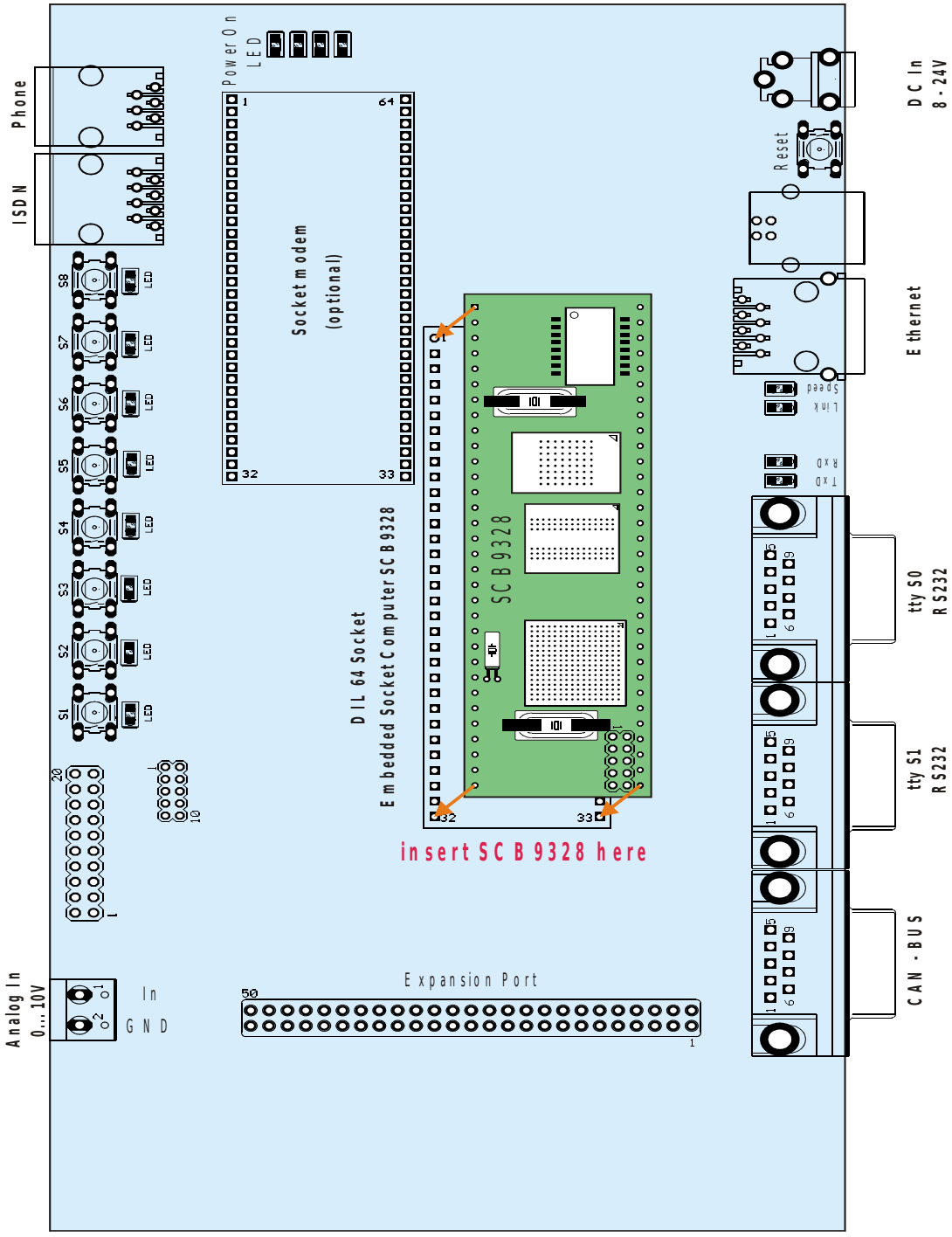
After pressing the OK-Button you are ready to communicate with the SCB9328. In der HyperTerminal Window press the “Call”-Button. When you power up your EVB9328 Professional Evaluation Board you should see the following startup message in the HyperTerminal Window:



Please note: Programming under Windows for the SCB9328 is not supported by the EVB9328 Professional Evaluation Board.

8 Component Placement

The following picture shows the connectors and other major parts of the EVB9328 Professional Evaluation Board.



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