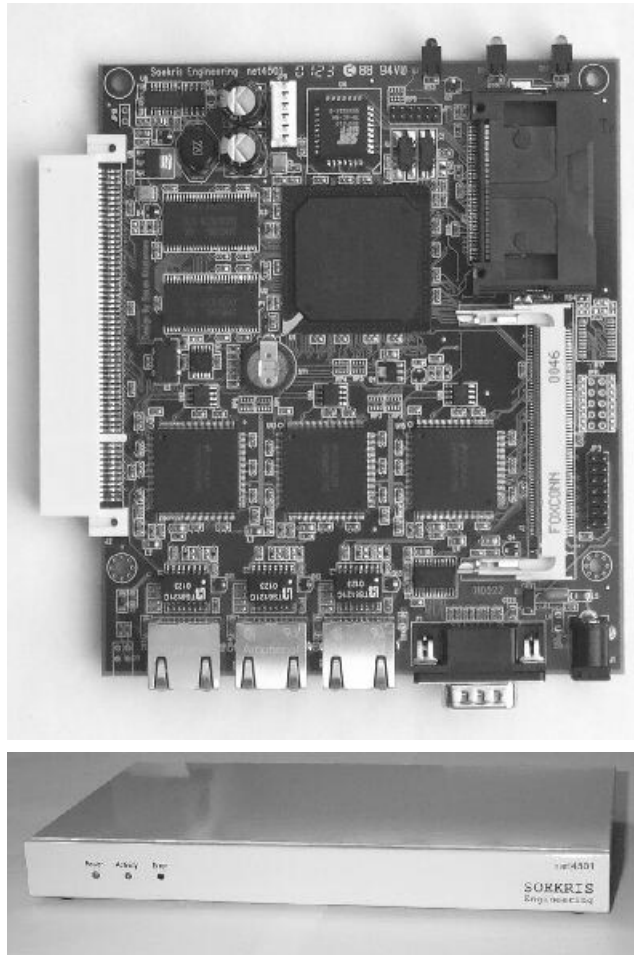


Soekris Engineering

net4501 series boards and systems. User's Manual



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1 Introduction

This manual describes the Soekris Engineering net4501 Series of boards and systems. The net4501 is available as a board only, or in a small sheet metal case. In both cases, they are available in different configurations.

The net4501 is based on the ElanSC520 embedded processor from AMD, and is basically a PC compatible embedded computer optimized for network and communication applications.

This manual assumes that the reader has a deep understanding of PC Architecture, and will only cover areas specific to the net4501. Most of the net4501 functionality and interfaces are either following official PC standards, or unofficial de-facto standards.

2 Specifications

2.1 Overview

Processor	Single Chip AMD ElanSC520, 100 Mhz or 133 Mhz clock.
Core Chipset	Integrated in the ElanSC520.
Main Memory	16-64 Mbyte PC100 SDRAM, soldered on board.
BIOS	128 Kbyte FLASH, soldered on board. Contain Soekris Engineering comBIOS.
Bus Expansion	1 - PCI slot, 3.3V only, limited power available. 1 - Mini-PCI type IIIA socket.
Ethernet	Up to three Ethernet Controllers using the National Semiconductor DP83815 PCI busmaster chip, supporting 10BaseT and 100BaseT. RJ-45 Connectors at board edge with built in LED's for link status and network activity.
Serial Ports	1 or 2 serial ports, using 16550 uarts in the ElanSC520. 1 standard with PC type DB-9 connector at board edge. 1 optional with 10 pins header.
Storage	1 CompactFlash type I/II socket.
Real Time Clock	Integrated in the ElanSC520. Backup power is provided by a rechargeable lithium battery, which can supply power for minimum 1 month.
Supervision	Watchdog timer, integrated in the ElanSC520.
General Purpose I/O	8 bits of programable input/output pins, connected directly to the ElanSC520.
Power Supply	6-20V DC, 10W maximum, using a DC input Jack at board edge, or 5V DC, using connector on board.
Power Consumption	Max 7W without using expansion connectors.
Environmental Conditions	Operating: 0°C - 60°C temperature 10% - 90% relative humidity, non condensing. Storage: -20°C - 85°C temperature 5% - 95% relative humidity, non condensing.
EMI/EMC	All interfaces intended for external connections are protected against emissions and immunity.
Agency Compliance	When using the optional metal case: CE Marking EN55022 Class A CE Marking EN55024 FCC Part 15 Class A
Physical Size	Board only: 4.85" x 5.70" (124mm x 145 mm) Small metal case: 5.95" x 6.2" x 1" (151mm x 158mm x 26mm) Wide metal case: 5.95" x 10.2" x 1" (151mm x 260mm x 26mm)

2.2 Bus Expansion

The net4501 has two different PCI expansion possibilities, the connector J2 is a standard 3.3V PCI v2.2 connector and J3 is a Mini-PCI type IIIA socket.

Please note that there is limited power available for the two PCI expansion connectors. There are only 3W available on the 3.3V power pins, there is no power available on the +12V and -12V power pins. And when using the DC Input Jack as the power source, only very limited amount of power is available on the 5V pins, as the 5V is then supplied by a linear regulator.

CAUTION: Please note that the Standard PCI connector is a 3.3V signaling only connector, and is keyed for that. Do not insert a 5V PCI expansion board upside down, that can cause permanent damage both to the net4501 and the expansion board.

3 BIOS

3.1 Overview

The net4501 comes with the Soekris Engineering netBIOS. The BIOS is designed especially for setup and operation using the serial port as the console. The BIOS is located in Flash memory, and can be upgraded over the serial port. Critical system setup parameters are also saved in the Flash memory, so the system will not lose any setup information due to CMOS battery backup power loss.

3.2 Serial Console

The net4501 does not have any video or keyboard interface, and uses the COM1 serial port for the primary console interface instead. The serial port default baud rate is 19200, but it can be changed by the monitor “set” command. The netBIOS also has an emulation of int10 video system calls and int16 keyboard system calls, making it possible to run old real mode programs that expect video and keyboard services. This is mostly useful for running MS-DOS, and is limited to software using the BIOS calls only. The serial port connector is a standard PC type 9 pins D-SUB, so a serial crossover cable should be used when connecting to another PC.

3.3 System Startup

When the net4501 is powered up or rebooted, the netBIOS will first display diagnostic checkpoint codes on the serial console. When it has located and checked the first 64 Kbytes of main memory, it will display a sign on message and then continue with additional testing and configuration. After that, it will start a short countdown before it will try to boot an operating system. During the countdown time, by pressing Ctrl-P, the normal boot process can be interrupted and control transferred to the comBIOS’s monitor program. The monitor is a command line driven program for setup and light diagnostic and debugging. Typing “?” or “help” at the command prompt will show a short list of commands available.

Note that after changing system parameters using the “set” command, it will be necessary to restart the system before the new parameters will be used, by using the “reboot” command.

3.4 Monitor Commands

boot [drive]

Load operating system from a boot device, using int19 system call. Drive can either be a valid int13 drive entered as a hexadecimal number, or a special number. For example “80” will be first fixed disk drive, normally the CompactFlash on the net4501, and that is also the default if no parameter is entered. Currently defined special number is “F0”, which will try to boot over the network, using the PXE boot ROM.

reboot

Will reboot the BIOS, normally used after changing system parameters.

download

Start downloading a binary image over the serial ports, using the XMODEM protocol. After entering the command, start sending at the terminal program at the other end. Will time out after 30 seconds if it does

not detect the start of a XMODEM transfer. Downloaded binary image will be saved in memory at 4000:0000.

flashupdate

Update the system flash BIOS with image at 4000:0000, normally the one just downloaded using the “download” command.

time [HH:MM:SS]

Update the time in the battery backed Real Time Clock, or if no parameter, show the current date and time. The time should be entered in 24 hours format, as “hour:minutes:seconds”.

date [YYYY/MM/DD]

Update the date in the battery backed Real time Clock, or if no parameter, show the current date and time. The date should be entered as “year/months/date”.

set parameter=value

Set a BIOS system parameter to a value. See section 3.4 for a list of currently available parameters to set. Note that a reboot is required after changing most parameters before the new value will be used.

show [parameter]

Show the current value of a parameter, or if no parameter, show a list of all parameters and their current value.

d[b|w|d] [adr]

List the content of the memory, in both ascii and hexadecimal. “db” will show it as 8 bit bytes, “dw” will show it as 16 bit words and “dd” will show it as 32 bit doublewords. “adr” is a memory address in hexadecimal, either in 16 bit seg:offset format or as a single linear 32 bit address. If no address is entered, it will continue listing from last address, if “d” is entered alone, it will list in the last used format.

i[b|w|d] port

Input and show the content of a port address. “ib” will input a 8 bit byte, “iw” will input a 16 bit word and “id” will input a 32 bit double word. The port address is in hexadecimal from 0 to FFFF.

o[b|w|d] port value

Output a value to a port address. “ob” will output a 8 bit byte, “ow” will output a 16 bit word and “od” will output a 32 bit double word. The port address is in hexadecimal from 0 to FFFF, and the value is a hexadecimal number.

e addr byte [...]

Enter values in memory. “adr” is a memory address in hexadecimal, either in 16 bit seg:offset format or as a single linear 32 bit address. “value” is one or more 8 bit bytes.

3.5 BIOS System Parameters

ConSpeed

Serial Console speed baud rate. Value can be 2400, 4800, 9600, 19200, 38400 or 57600, default is 19200.

ConLock

Protecting the serial console port from modifications using int14 system calls. Value can be “enabled” or “disabled”, default is “enabled”. Useful for preventing MS-DOS from changing the console speed on start up.

BIOSentry

To control if the “Press Ctrl-P for entering Monitor.” message should be displayed during before booting. Value can be “enabled” or “Disabled”, default is “enabled”. Useful for making it harder for end users to enter the monitor and modify BIOS settings. Note that pressing “Ctrl-P” will still work for entering the monitor.

PCIROMS

To control if the BIOS will execute code found in PCI expansion ROM’s. Value can be “enabled” or “disabled”, default is “enabled”. Can be used to disable problematic ROM’s on PCI boards, or to shorten the BIOS boot time.

FLASH

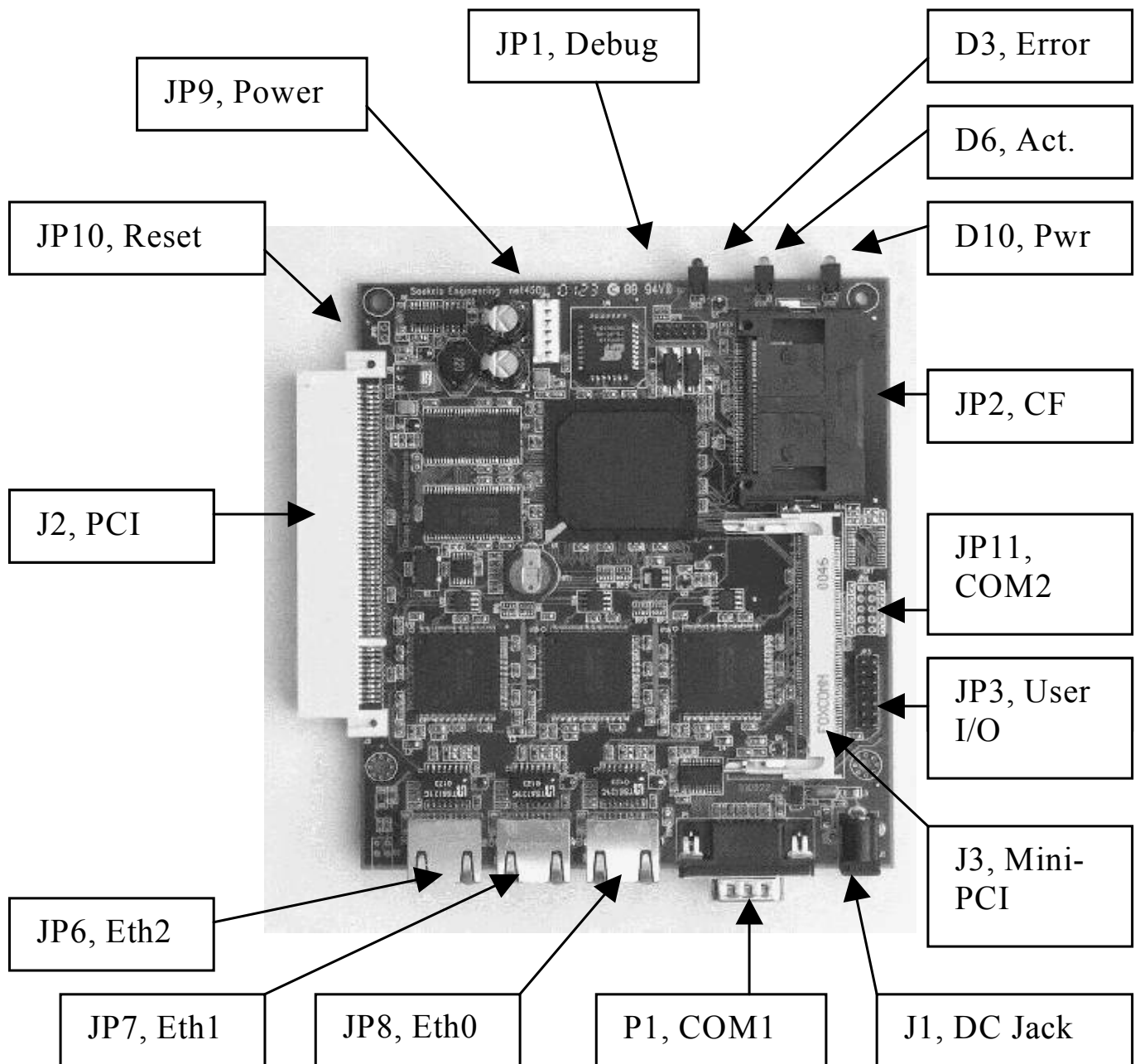
To set the disk channel of the onboard CompactFlash socket. Value can be “primary” or “secondary”, default is “primary”. Useful if the system is used with an external IDE controller.

BootDelay

To set the delay time before booting an operating system. Value can be from 2 to 16 seconds, default is 5 seconds.

4 Connectors and Indicators

The following sections provide pin definitions and descriptions of all onboard connectors and LED indicators. Some of the connectors are on located along one edge of the board, and are designed for access though the rear of the optional sheet metal case. The LED indicators are located along the opposite board edge, and are designed to be viewed from the front of the case.



4.1 J1, DC Input Jack

The 2.1mm DC Power Jack should be used for connecting a small wall mount unregulated power adapter, supplying 9V-12V DC at 10 VA, with a 5.5mm outside, 2.1mm inside female power plug with plus at center pin. It is protected against reverse polarity.

4.2 J2, 3.3V PCI Connector

PCI rev 2.2 connector, please see the PCI Specification rev 2.2 for pin layout and electrical specifications. Also, please see the “Bus Expansion” section for limitations.

4.3 J3, Mini-PCI Socket

Mini-PCI type IIIA socket, please see the Mini-PCI Specification rev 1.0 for pin layout and electrical specifications, also, please see the “Bus Expansion” section for limitations.

4.4 JP1, Debug header

Debug connector for the AMD ElanSC520 processor. 10 pins 2mm header. Please see the Elan SC520 microcontroller users manual for more information.

4.5 JP2, CompactFlash socket

CompactFlash type I/II socket. This interfaces to the SC520 processor as an IDE controller, and can be set for either the primary or secondary controller. Please see the Compact Flash Specification rev 1.4 for pin layout, mechanical and electrical specifications.

4.6 JP3, User I/O

14 pins 0.050” header with 8 programmable general purpose input/output pins. They are connected directly to the Elan SC520 processor, please see the Elan SC520 microcontroller users manual for programming information and the Elan SC520 data sheet for electrical specifications. When the board is viewed as on the illustration, pin 1 is the top left pin, at the “JP3” text.

SC520 Pin	Function	Pin Number		Function	SC520 Pin
--	+3.3V Power	1	2	+5V Power	--
PIO5, AD10	GPIO 0	3	4	GPIO 1	PIO6, AE10
PIO7, AF10	GPIO 2	5	6	GPIO 3	PIO8, AF9
PIO21, AF6	GPIO 4	7	8	GPIO 5	PIO22, AF5
PIO11, AC9	GPIO 6	9	10	GPIO 7	PIO12, AC8
--	GND	11	12	GND	--
--	GND	13	14	n-c	--

4.7 JP6-JP8, Ethernet Jacks.

8 pins shielded RJ-45 jacks with built in LED’s for link status and network activity. Auto detects between 10baseT or 100baseT. When viewed from the rear, the left LED is link status, will be yellow when set for 10baseT and green when set for 100baseT, and the right LED will be green if there is network activity. When software uses the BIOS PCI functions for searching for PCI devices, JP8 will be the first found, JP7 the second and JP6 the third found.

4.8 JP9, DC Power

6 pins AMP MTA100 header, for connecting of internal power supply. Also has 2 of the GP IO pins, for use with advanced power management. Can be used with a 5V DC power supply if pin 3 and 4 are connected together, or with a 6V – 20V DC power supply if only pin 3 are used. When the board is viewed as on the illustration, pin 1 is the top pin, at the JP9 text.

Function	Pin Number
GND	1
GND	2
VPWR	3
+5V	4
GPIO 4	5
GPIO 0	6

4.9 JP10, Reset

2 pins 0.050" header. Shorting the two pins together will hard reset the board.

4.10 JP11, COM2

10 pins 0.050" header for serial port COM2. Can be connected to a DB9 using a de facto standard cable assembly. When the board is viewed as on the illustration, pin 1 is the top left pin, at the "JP11" text.

DB9 Pin	Function	Pin Number		Function	DB9 Pin
1	DCD	1	2	DSR	6
2	RXD	3	4	RTS	7
3	TXD	5	6	CTS	8
4	DTR	7	8	RIN	9
5	GND	9	10	n-c	

4.11 P1, COM1

9 pins DB9 connector for serial port COM1. The pinout follow the de facto standard for DB9 PC serial ports. Normally used for serial management console.

4.12 D3, Error LED

This red LED is connected to the SC520 processor PIO9, pin AF9. It is connected so that it will be on at power on, and can then be turned off and on by software control. When programming PIO9 with a 0, it will be off. The BIOS will normally turn it off just before booting an operating system.

4.13 D6, Network Activity LED

This green LED is a logical OR of the activity LED's on the ethernet connectors.

4.14 D10, Power On LED

This green LED will be on when there is applied power to the board.

5 Software Installation

The net4501 is designed to be fully PC compatible, but has some limitation due to the design decision to leave out the video, keyboard, floppy and IDE interfaces.

5.1 CompactFlash use

The CompactFlash socket is the only medium for permanent program and data storage. There are two ways of loading software on the CompactFlash card.

- Booting an install program using the PXE boot ROM, and then installing the rest over the network. Only some operating systems support PXE booting and/or installation over the network.
- Preloading the CompactFlash card on another system. As the CompactFlash emulates an IDE device, it can be connected to a host system using either an IDE-CompactFlash adapter, a PCMCIA to

CompactFlash adapter or a USB based reader/writer. Differences in sector translation using IDE devices can complicate doing the loading on another system. The net4501 uses a simple algorithm for sector translation, if there are less than 1024 tracks, it will use the native CHS that the CompactFlash reports, if more than 1024 tracks, it will use LBA translation. So the host system will need to match that, and that will also normally be the case. In some cases it may be necessary to change the translation settings in the host system's BIOS.

5.2 Ethernet Drivers

The used DP83815 ethernet controller is directly supported by the newer versions of most operating systems, and will normally be automatically detected. As it is a relatively new chip, it may be necessary to upgrade to the newest version, or to locate device drivers. For most operating systems, drivers are available on National Semiconductors website at <http://www.national.com>