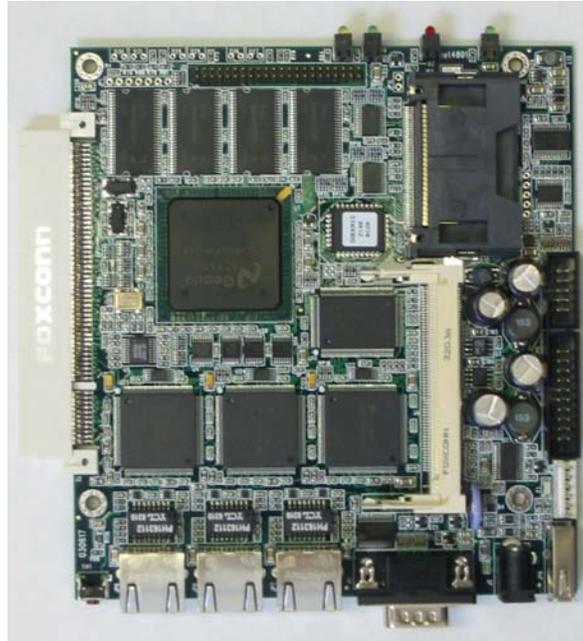# Soekris Engineering

net4801 series boards and systems.
User's Manual

Vers 0.05 – April 10, 2004

Table of Contents

1 Introduction

This manual describes the Soekris Engineering net4801 Series of boards and systems. The net4801 is available as a board only, or in a small sheet metal case. In both cases, they are available in different configurations.

The net4801 is based on the SC1100 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 net4801. Most of the net4801 functionality and interfaces are either following official PC standards, or unofficial de-facto standards.

Specifications

1.1 Overview

Processor	Single Chip AMD SC1100, 233 Mhz or 266 Mhz clock.
Core Chipset	Integrated in the SC1100
Multi-IO	NSC PC87366
Main Memory	32 to 128 Mbyte PC133 SDRAM, soldered on board.
BIOS	512 Kbyte FLASH, soldered on board. Contain Soekris Engineering comBIOS.
Bus Expansion	1 - PCI slot, 3.3V singnaling only, limited power available. 1 - Mini-PCI type IIIA socket.
Ethernet	Up to three Ethernet Controllers using the National Semiconductor DP83816 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 16C550 uarts. 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 SC1100. Backup power is provided by a rechargeable lithium battery, which can supply power for minimum 1 month.
Supervision	Watchdog timer, integrated in the SC1100. Temperature monitor, integrated in the PC87366. Voltage monitor, integrated in the PC87366.
General Purpose I/O	12 bits of programmable input/output pins, connected directly to the PC87366.
Power Supply	6 to 28V DC, 15W maximum, using a DC input Jack at board edge, **or** 5V DC, using connector on board.
Power Consumption	Max 5W without using expansion connectors.
Environmental Conditions	Operating: 0°C to 60°C temperature 10% to 90% relative humidity, non condensing. Storage: -20°C to 85°C temperature 5% to 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 1.3" (151mm x 158mm x 33mm) Wide metal case: 5.95" x 8.5" x 1.3" (151mm x 216mm x 33mm)

1.2 Bus Expansion

The net4801 has two different PCI expansion possibilities, the connector J3 is a standard 3.3V PCI v2.2 connector and J4 is a Mini-PCI type IIIA socket.

Please note that there is limited power available for the two PCI expansion connectors. There are only 10W available on the 3.3V power pins and 5V pins combined. If a 2.5" hard disk is used, it will also need to share the available power.

An onboard DC-DC converter supplies +12V @ 0.3A and –12V @ 0.1A to the PCI connector.

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 to both the net4801 and the expansion board.

1.3   Multi-IO Controller

The net4801 has an onboard Multi-IO controller which provide the 2nd serial port, Voltage and Temperature monitor and the GPIO pins. The Multi-IO controller is connected via the LPC bus and its configuration register index/data pair is located at hex 2E and 2F. The comBIOS program all the base address locations, but the actual addresses need to be determined by reading the Multi-IO configuration registers.

2 BIOS

2.1   Overview

The net4801 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.

2.2   Serial Console

The net4801 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.

The connected ANSI/VT100 terminal or terminal emulator should be set for 19200 baud, 8 databits, no parity, 1 stop bit, no flow control.

2.3   System Startup

When the net4801 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 parametes using the "set" command, it will be necessary to restart the system before the new parameters will be used, by using the "reboot" command.

2.4   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 net4801, 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 parametes 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[b|w|d] addr value [...]

Enter values in memory. "eb" will enter a 8 bit byte, "ew" will enter a 16 bit word and "ed" will enter a 32 bit double word. "adr" is a memory address in hexadecimal, either in 16 bit seg:offset format or as a single linear 32 bit address.

2.5   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.
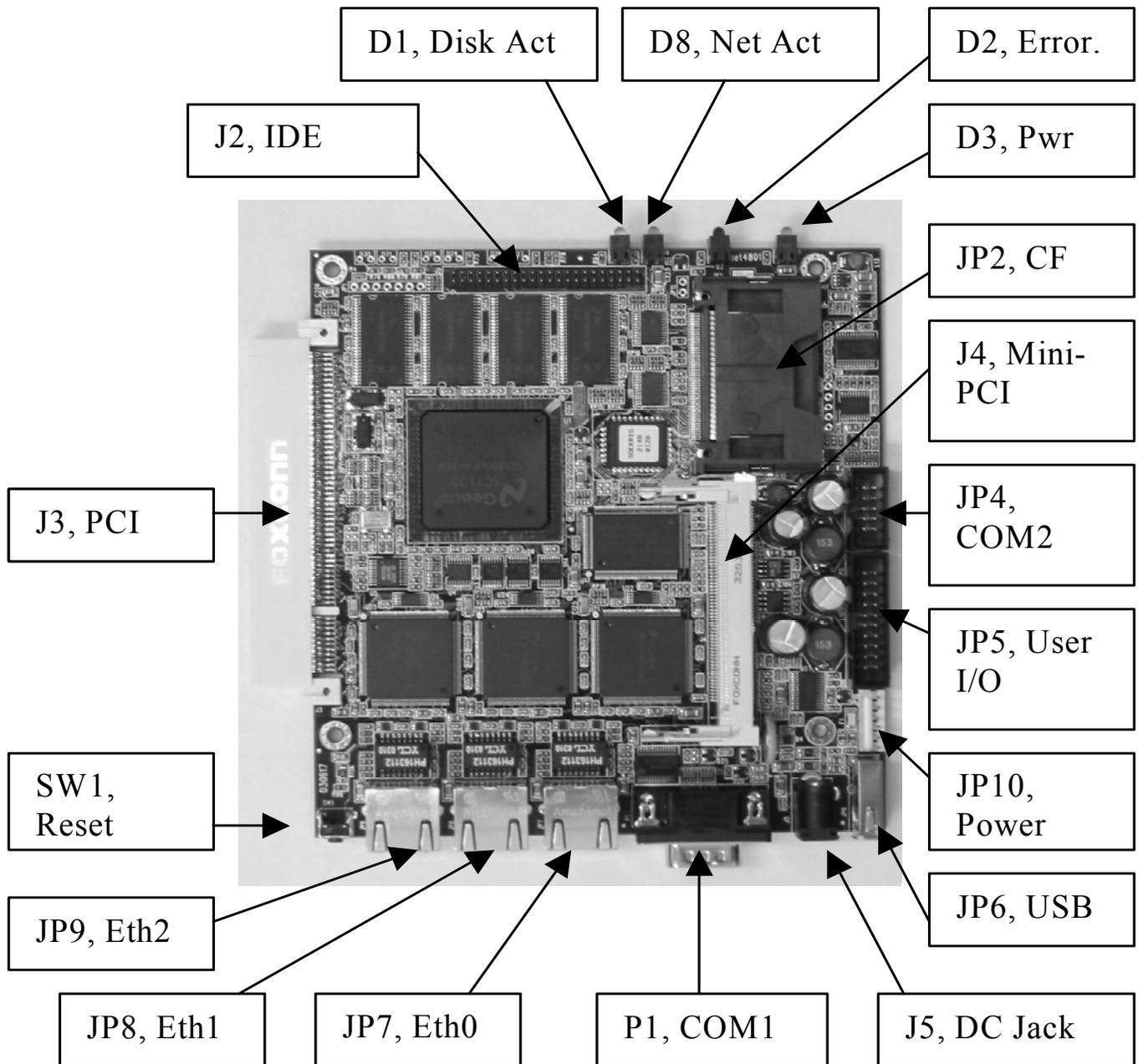
FLASH

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.

3 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.

D1, Disk Act

D8, Net Act

D2, Error.

J2, IDE

D3, Pwr

JP2, CF

J4, Mini-PCI

J3, PCI

JP4, COM2

JP5, User I/O

SW1, Reset

JP10, Power

JP9, Eth2

JP6, USB

JP8, Eth1

JP7, Eth0

P1, COM1

J5, DC Jack

3.1 J5, DC Input Jack

The 2.1mm DC Power Jack should be used for connecting a small wall mount unregulated power adapter, supplying 6V-28V DC at 15 VA, with a 5.5mm outside, 2.1mm inside female power plug with plus at center pin. It is protected against reverse polarity. Please note that standard unregulated power transformers can supply much higher voltage that the specified nominal voltage, so when using such a type it's recommended to use one that is specified for 16V DC or less.

3.2   J3, 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.

3.3   J4, 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.

3.4   JP2, CompactFlash socket

CompactFlash type I/II socket. This interfaces to the SC1100 processor as an IDE controller, and can be set for either the master or slave on the controller. Please see the Compact Flash Specification rev 1.4 for pin layout, mechanical and electrical specifications.

3.5   JP5, User I/O

20 pins 0.050" header with 12 programmable general purpose input/output pins and com2 serial port access at TTL level. They are connected directly to the PC87366 Multi-IO controller, please see the PC87366 datasheet for programming information and electrical specifications. When the board is viewed as on the illustration, pin 1 is the top left pin, at the "JP5" text.

PC87366 Pin	Function	Pin Number		Function	PC87366 Pin
--	+3.3V Power	1	2	+5V Power	--
GPIO20, 117	GPIO 0	3	4	GPIO 1	GPIO21, 118
GPIO22, 119	GPIO 2	5	6	GPIO 3	GPIO23, 120
GPIO24, 121	GPIO 4	7	8	GPIO 5	GPIO24, 122
GPIO26, 123	GPIO 6	9	10	GPIO 7	GPIO26, 124
--	GND	11	12	GPIO 8	GPIO4, 6
GPIO5, 7	GPIO 9	13	14	GND	--
GPIO13, 55	GPIO 10	15	16	GPIO 11	GPIO12, 54
	GND	17	18	RXD	SIN2, 105
SOUT2, 107	TXD	19	20	GND	

3.6   JP7-JP9, 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, JP7 will be the first found, JP8 the second and JP9 the third found.

3.7   JP10, 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 to 28V 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 JP10 text.

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

3.8   SW1, Reset

Small switch, usually accessible though a small hole in the case. Can be selected to work either as a "hard" processor reset or as a "soft" software readable reset.

3.9   JP4, 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 "JP4" 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	+5V Power	

3.10 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.

3.11 D2, Error LED

This red LED is connected to the SC1100 processor GPIO20, pin D21. 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 GPIO20 with a 0, it will be off. The BIOS will normally turn it off just before booting an operating system.

3.12 D8, Network Activity LED

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

3.13 D3, Power On LED

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

3.14 D1, Disk Activity LED

This yellow LED will be on when there is disk activity, either by the CompactFlash module or the optional Hard Disk.

4 Software Installation

The net4801 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.

4.1   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 net4801 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.

4.2 Ethernet Drivers

The used DP83816 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