# Arcom ELAN-104NC
## PC/104 Compatible
## Embedded Processor Card

## Technical Manual

# Product Information

Full information about other Arcom products is available by contacting our WebSite at: **www.arcomcontrols.com**

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*Arcom Control Systems Ltd operate a company-wide quality management system which has been certified by the British Standards Institution (BSI) as compliant with ISO9001:1994*

# Contents

# Revision History

| Manual | PCB | Comments | |
|--------|-----|----------|---|
| Iss A | V1 Iss1 | 991105 | First release of manual |
| Iss B | V2 Iss 1 | 000306 | [ECO 2864] |
| Iss C | V2 Iss 1 | 000328 | [ECO 2878] |
| Iss D | V2 Iss 3 | 010619 | [ECO 2960] |

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## Anti-Static Handling

This board contains CMOS devices that could be damaged in the event of static electricity being discharged through them. At all times, please observe anti-static precautions when handling the board. This includes storing the board in appropriate anti-static packaging and wearing a wrist strap when handling the board.

## Battery

The board contains a Lithium non-rechargeable battery. Do not short-circuit the battery or place on a metal surface where the battery terminals could be shorted. During shipment the battery is isolated from the board's circuitry and should be connected before using the board. Please refer to the link section of this manual for details.

When disposing of the board or battery, take appropriate care. Do not incinerate, crush or otherwise damage the battery.

## Packaging

Please ensure that should a board need to be returned to Arcom Control Systems, it is adequately packed, preferably in the original packing material.

## Electromagnetic Compatibility (EMC)

Electromagnetic Compatibility testing has been performed using the ELAN-104NC product as a component in Arcom's CE marked ACEpc system. Radiated and Conducted EM emissions comply with standards for light industrial equipment. However, the ELAN-104NC is classified as a component with regard to the European Community EMC regulations and it is the users responsibility to ensure that systems using the board are compliant with the appropriate EMC standards

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 Arcom Control Systems has a team of technical support engineers who will be able to provide assistance if you have any problems with this product.  Please contact the support team at support@arcom.co.uk or support@arcomcontrols.com for US customers.

# Introduction

This manual describes the operation and use of Arcom's ELAN-104NC Single Board Computer. It has been designed as both a reference and a user manual and includes information on using all aspects of the board.

This board should have been supplied as part of an ELAN-104NC development kit and you should already have read the 'Quickstart' manual supplied.

The ELAN-104NC is a Eurocard sized, PC/AT compatible processor board designed to be embedded into OEM equipment. It contains all the standard features found in a PC/AT system with some embedded additions. These include silicon disk drive, Ethernet controller, PC/104 expansion bus and high performance flat panel VGA controller.

The board can be purchased in the following standard variants:-

| | |
|---|---|
| ELAN-104NC-100-M16-F8 | 100MHz CPU, 16MB DRAM, 8MB Flash |
| ELAN-104NC-100-M4-F4 | 100MHz CPU, 4MB DRAM, 4MB Flash |

Contact Arcom Control Systems sales for pricing and availability.

## Features

CPU:
- AMD Elan SC400 100MHz processor (Am486 CPU without floating point)

Cache:
- 8K L1 write-back cache

BIOS:
- Datalight BIOS in Flash EPROM
- Intel/Chips & Technologies 65550 HiQVideo BIOS
- Onboard reprogramming

System Memory:
- Up to 16MB EDO DRAM

Silicon Disk:
- Up to 8MB Intel Strata Flash
- Datalight FlashFX Flash filling system

Ram Disk:
- 128KB SRAM Disk (battery backed)

Video:
- Intel/Chips and Technologies 65550 HiQVideo Controller
- 1MB EDO DRAM
- SVGA for CRT and Flat panel displays
- 32-bit VESA bus interface
- VGA BIOS integrated into system ROM
- Simultaneous CRT and Flat panel display

Integrated I/O:
- SMSC FDC37C932 with built in Real Time Clock and Keyboard controller

IDE Interface:
- Supports up to two IDE devices

FDD Interface:
- Supports two floppy drives 360KB, 720KB, 1.2MB, 1.44MB, 2.88MB

Parallel Port:
- High speed parallel port, SPP/EPP/ECP modes
- BIOS Configurable

Serial Ports:
- Three 16C550 compatible high speed UART's
- 2 x RS232 and 1 x RS422/485 Interfaces

Network support:
- RealTek RTL8019A 10-BaseT Ethernet controller
- 16-bit ISA interface

Miscellaneous Features
- 8bits of general purpose I/O
- Piezo electric speaker

# Getting Started

The development kit contains a "Quickstart" manual that has been designed to enable users to set-up and start using the board as soon as possible. You should read this manual and follow the steps defining how to set-up the board. Once you have completed this task you will have a working ELAN-104NC system and can start adding other peripherals to enable you to start development.

The section below has been designed to guide you through setting up and using some of the features of the ELAN-104NC. If you would like more detailed information on any aspect of the board refer to the "Detailed Hardware Description" section of this manual.

## Using the ELAN-104NC

The ELAN-104NC uses a Datalight BIOS (Basic Input-Output System) to provide support for the board. The BIOS has a built-in set-up program that allows users to modify the basic system configuration. The set-up program can be invoked during the power on sequence by pressing any key when prompted during boot-up. The set-up parameters are stored in the CMOS RAM and will be retained when the power is switched off if the battery backup supply is connected (See link and connector section for details).

The BIOS defaults have been selected to enable the board to operate with a minimum of devices connected. If CMOS settings are lost the board will correctly power up and boot from the on-board flash disk, without any other peripherals connected.

**Connecting a Floppy disk drive**
The ELAN-104NC supports up to two standard floppy disk drives. These can be connected to PL9 via a 34-way twisted ribbon cable. Both disk drives should be configured to use drive select 1, Drive A: should be connected via a twisted cable and DRIVE B: via a straight cable. The BIOS default configuration assumes that a 1.44MB floppy disk drive is connected as drive A:. If you require a different configuration you must configure the BIOS using the set-up screen.

**Note:** In order to support two floppy disk drives at the same time the 34 way cable should be fitted with three connectors. The board connector and one of the drive connectors should be fitted 1:1 and the third connector should have a twist in the cable that swaps pins 10 to 16 on this connector.

**Connecting a Hard disk drive**
The ELAN-104NC can support up to two IDE hard disk drives. Both drives should be connected to PL8 via a 40-way 1:1 cable. The primary drive should be set-up as a 'MASTER' and the secondary drive as a 'SLAVE'. The BIOS will automatically detect the hard disk drive during the POST (Power-on Self-Test) processes and configure the hardware correctly. The BIOS will attempt to load an operating system from the primary disk drive. If the operating system is DOS based, this drive will become DRIVE C: once the operating system has loaded. If the on board Flash memory is fitted and has been formatted as a silicon disk drive, then this will be allocated as the last drive in the system.

**Connecting a CD-ROM (IDE Type)**
If a CD-ROM drive is required in the system, it may be connected in place of the secondary drive detailed above. The CD-ROM should be configured as a 'SLAVE' device. Drivers will be required to support the drive under DOS.

### Connecting a Mouse

A PS/2 mouse can be connected to PL16. A suitable mouse is supplied as part of the development kit. A driver has been included on the support CD-ROM to enable this mouse to be used under DOS. Windows 95 provides mouse support via built in drivers.

### Using the Serial interfaces

The two RS232 serial port interfaces on the ELAN-104NC are fully PC compatible. They are decoded at standard PC address locations for COM1 and COM2. PC applications will be able to use these ports without any special configuration.

Connection to the serial ports is via 9-way D-Type connectors (PL7, PL14). The D-Type connectors are compatible with the standard 9-way connector on a desktop machine.

| 9-way D-Type Plug | Signal Name |
|---|---|
| 1 | Data Carrier Detect (DCD) |
| 2 | Receive Data (RX) |
| 3 | Transmit Data (TX) |
| 4 | Data Terminal Ready (DTR) |
| 5 | Ground |
| 6 | Data Set Ready (DSR) |
| 7 | Request To Send (RTS) |
| 8 | Clear To Send (CTS) |
| 9 | Ring Indicator (RI) |

COM3 is an RS422 full duplex or an RS485 half duplex (link selectable) communications port. Connection to COM3 is via a 10-way header (PL3). See Appendix A - Connections, for the pin out details.

### Connecting a Printer

An enhanced printer port has been incorporated onto the ELAN-104NC. This port can be used to support a 'CENTRONICS' compatible printer or ECP/EPP bi-directional device. The signals are routed to a 26 way boxed header and the pin assignment has been arranged to allow 1:1 connection with a 25 way IDC D-Type socket. This socket is compatible with a standard printer port connector on a desktop machine.

| 26 way Header | Signal Name | 25 way D-Type Socket |
|---|---|---|
| 1 | STROBE | 1 |
| 2 | AUTOFEED | 14 |
| 3 | D0 | 2 |
| 4 | ERROR | 15 |
| 5 | D1 | 3 |
| 6 | INIT | 16 |
| 7 | D2 | 4 |
| 8 | SELECT IN | 17 |
| 9 | D3 | 5 |
| 10 | Ground | 18 |
| 11 | D4 | 6 |
| 12 | Ground | 19 |
| 13 | D5 | 7 |
| 14 | Ground | 20 |
| 15 | D6 | 8 |
| 16 | Ground | 21 |
| 17 | D7 | 9 |
| 18 | Ground | 22 |
| 19 | ACKNOWLEDGE | 10 |
| 20 | Ground | 23 |
| 21 | BUSY | 11 |
| 22 | Ground | 24 |
| 23 | PAPER END | 12 |
| 24 | Ground | 25 |
| 25 | SELECT | 13 |
| 26 | No Connect | - |

**Using the Flat Panel Interface**
The Intel/Chips and Technologies 65550 VGA controller used on the ELAN-104NC supports a wide range of flat panel displays as well as a conventional CRT monitor. Flat panel support can be configured by modifying the registers within the VGA device. The VGA BIOS sets up these registers during the POST process and can be modified to support various displays.

The default BIOS for the ELAN-104NC autodetects the presence of a CRT display. If a CRT is attached flat panel output is disabled. If a CRT is not attached, flat panel output is enabled. This ensures that you can plug in a standard PC style monitor and start using the board straight away. If you require the Flat Panel and CRT to run simultaneously, use the 'SM.COM' utility on the support CD. The default BIOS can be used to drive a 6.5" NEC TFT flat panel, part number NL6448BC20-08. This panel is supplied in the Flat Panel variant of the ELAN-104NC development kit. The development kit also contains an FPIF (Flat Panel Interface Board) and associated cables to enable connection of the display. The FPIF board and connection details for this display are described in Appendix E.

If you wish to use this display then connect it to the ELAN-104NC via the flat panel interface connector PL1 and the FPIF board.

For details on other flat panels supported by the ELAN-104NC contact Arcom Control Systems Technical Support.

**Using the PC/104 Expansion Bus**
PC/104 modules can be used with the ELAN-104NC to add extra functionality to the system. The PC/104 interface supports 8/16 bit ISA bus style interfaces.

Arcom Control Systems have a wide range of PC/104 modules that are compatible with the ELAN-104NC. These include modules for digital I/O, analogue I/O, motion control, video capture, CAN bus, serial interfaces etc. Please contact Arcom sales if a particular interface you require does not seem to be available as these modules are continually being developed. Other manufacturers' boards can also be used with this interface if they conform to the PC/104 specification.

In order to use a PC/104 board with the ELAN-104NC it should be plugged into PL15 for 8-bit cards and PL15/PL18 for 16-bit cards. Before powering up the system ensure that you have checked that the link settings on the card for I/O address, IRQ and DMA settings do not conflict with any devices on the ELAN-104NC.

If you are using a PC/104 card that requires +5V, this will automatically be supplied via the PC/104 header. If you require +12V or -12V, these will only be available if the +12V or -12V pins respectively on the 'POWER' connector PL17 have been connected to a supply. If you require -5V, this will need to be supplied directly to the PC/104 board.

**Using the Ethernet Interface**
The RealTek RTL8019AS ethernet controller is used on the ELAN-104NC. Drivers for various operating systems are supplied on the support CD-ROM. The appropriate driver must be loaded before the ethernet interface can be used.

Connection is made via the 8 way RJ45 connector PL5. A second connector PL10 provides outputs that can be used to control LED's for TX, RX and LINK status.

# Links

There are configuration selectable links on the ELAN-104NC. The following section provides details on these links. The '+' sign indicates the default position for each link.
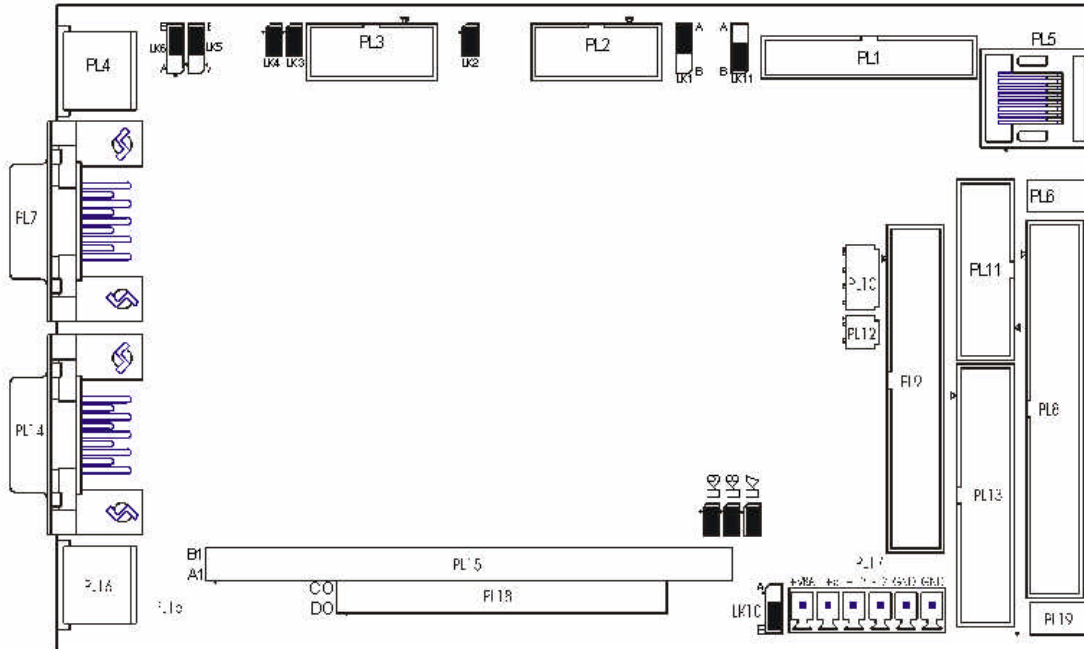


### LK1 - LCD Flat Panel logic power supply voltage
Link 1 selects the voltage for the LCD flat panel logic supply (VDDSAFE).
See also: LK11

| LK1 | Description |
|-----|-------------|
| A+ | 5V Flat Panel voltage |
| B | 3.3V Flat  Panel voltage |

### LK2 - User Link
This link is a user configuration link. It has no reserved function on the ELAN-104NC, but can be used by an application program to signify a configuration setting. The position of this link can be read via the chip setup and control  (CSC) indexed registers at I/O addresses 22h/23h (Index A7h Bit 7). See the Elan SC400 Microcontroller Register Set Reference Manual for further details. The Development Kit CD contains example code, demonstrating how this is done.

| LK2 | Description |
|------|-------------|
| Fit+ | GPIO_CS14 is 'Logic 0' |
| Omit | GPIO_CS14 is 'Logic 1' |

### LK3, LK4, LK5 and LK6 - RS422/485 Configuration
These links are used to configure the RS422/485 serial interface. They can be used to select either RS485 (half-duplex) or RS422 (full-duplex) connection and RS422/485 line termination. See the RS422/485 Interface section in the "Detailed Hardware Description" section of this manual for more details.

| LK3 | Description |
|------|-------------|
| Fit+ | RS422 TX line termination resistor (120Ω) connected |
| Omit | RS422 TX line termination resistor (120Ω) disconnected |

| LK4 | Description |
|------|-------------|
| Fit+ | RS485 (RS422 RX line) termination resistor (120Ω) connected |
| Omit | RS485 (RS422 RX line) termination resistor (120Ω) disconnected |

| LK5 and LK6 | Description |
|-------------|-------------|
| A+ | RS485 half-duplex connection |
| B | RS422 full-duplex connection |

**Note:** Both LK5 and LK6 must be set to the same position, i.e. both set to 'A' or both set to 'B'.

### LK7 - Hardware Watchdog Timeout Delay

The hardware watchdog timer has two pre-configured timeout delays. The delay is either 2 or 8 seconds. This link can be used to select between the two-timeout periods. See also: LK9

| LK7 | Description |
|-------|-------------|
| Fit | 2 second timeout |
| Omit+ | 8 second timeout |

### LK8 - SuperIO Watchdog Timer Enable

The SuperIO watchdog timer can be enabled or disabled with this hardware link. This link enables/disables the facility of using the watchdog. It must also be enabled in software. See the Watchdog Timers section in the 'Detailed Hardware Description' section of this manual for more details.

| LK8 | Description |
|-------|-------------|
| Fit | Watchdog (SuperIO) enabled |
| Omit+ | Watchdog (SuperIO) disabled |

### LK9 – Hardware Watchdog Timer Enable

The hardware watchdog timer can be enabled or disabled with this hardware link.
See also: LK7

| LK9 | Description |
|-------|-------------|
| Fit | Watchdog (hardware) enabled |
| Omit+ | Watchdog (hardware) disabled |

The hardware watchdog will only operate if this link is fitted, and if software triggers the watchdog by putting a low going pulse on WDOGTRIG# (GPIO17 of the SC400). Once the watchdog has been triggered, it must be re-triggered continuously in the software before the timeout period (LK 7). A timeout will generate a CPU reset. See the Watchdog Timers section in the 'Detailed Hardware Description' section of this manual for more details.

### LK10 - Clear CMOS/ Battery disable

A battery link is fitted that is used to prevent drain on the battery during shipment. This link can also be used to clear the contents of the CMOS RAM.

| LK10 | Description |
|------|-------------|
| A | Battery Backup enabled |
| B + | Battery Backup Disabled (CMOS RAM cleared) |

**LK11 - LCD Flat Panel backlight inverter power supply voltage**
Link 11 selects the voltage for the LCD backlight supply (BKLSAFE). See also: LK1

| LK11 | Description |
|------|-------------|
| A | 12V Backlight Power |
| B + | 5V Backlight Power |

## Connectors

There are 19 connectors on the ELAN-104NC that allow you to connect external devices such as a keyboard, floppy disk drives, hard disk drives and a printer. Detailed pin assignments are shown in Appendix A**.**

| Connector | Description |
|-----------|-------------|
| PL1 | VGA Flat Panel Interface |
| PL2 | General Purpose IO |
| PL3 | COM3 RS422/485 Serial Port |
| PL4 | PS/2 Keyboard |
| PL5 | Ethernet Interface |
| PL6 | Suspend/Resume Header |
| PL7 | COM1 RS232 Serial Port |
| PL8 | IDE Interface |
| PL9 | Floppy Disk Interface |
| PL10 | Ethernet Controller Status LED Header |
| PL11 | VGA CRT Interface |
| PL12 | PC Speaker Header |
| PL13 | Parallel Port Interface |
| PL14 | COM2 RS232 Serial Port |
| PL15 | 64-way PC/104 Expansion (8-bit) |
| PL16 | PS/2 Mouse |
| PL17 | Elan-104NC Power Supply Connector |
| PL18 | 40-way PC/104 Expansion (16-bit) |
| PL19 | Reset Switch Header |

# Datalight BIOS Set-up

The Datalight BIOS Setup program provides a wide range of typical BIOS settings. In addition, the Datalight BIOS Setup offers features designed specifically for the embedded market, such as disabling floppy and/or hard disk devices to reduce power and speed boot-time on those systems operating on a flash disk.

If you are used to other BIOS's, one typical BIOS setup option might appear to be missing: hard drive type. This is intentional. Hard drives can be identified by recording internal configuration data. The Datalight BIOS uses this to autodetect the hard drive type without user intervention. This means, if you change either the number or type of hard drives, there is no reason to enter set-up.

The following sections describe the setup navigation, and the entire set of options.

## Set-up Menu Navigation

The Datalight BIOS Setup is available upon boot of the Arcom ELAN-104NC. The key F2 enters set-up when in full-keyboard mode; the ASCII key '2' enters set-up when in serial-keyboard mode. Unlike other BIOS's, the Datalight BIOS Set-up is presented as TTY-style menus, rather than pop-up menus. This allows set-up to be used in an identical manner across a remote serial console as well as with a full screen and keyboard.

Three cursor keys allow easy navigation of the TTY-style menus, as described in the table below:

Enter        Accept the default, as displayed under the cursor
Esc           Done. Go to the next option.
Backspace    Go to previous option. If on the save/exit option, go to start of set-up menu.

Some set-up options allow simple yes/no answers. For those options that allow more choices, a list of legal values is displayed on the line above. All responses are single character responses, which minimises the keystrokes required to navigate the text menus.

# Set-up Options

Datalight BIOS Set-up

**Main Menu**
Restore Defaults?
Disk Options?
Serial Options?
Video Options?
Printer Options?
Power Settings?
Miscellaneous Options?
Save changes and exit or Quit (S, Q)?

**Restore Defaults?**
Confirm this option to restore the factory default configuration. These stored defaults can be changed, refer to the CMOS Defaults section below.

**Disk Options**
Display/Change *Boot Order? Y*

        Current Order:
        1st Boot Device: Floppy
        2nd Boot Device: Hard Disk
        3rd Boot Device: None

The boot order option chooses which devices the BIOS looks for when it is time to boot the operating system. For purposes of this menu item, the Datalight FlashFX Flash Drive is treated as a hard disk.

 Display/Change Floppy *Drive Types? Y*

        1st Floppy Drive Type: 1.44M
        2nd Floppy Drive Type: None
        N = None, A = 360K, B = 1.2M, C = 720K, D = 1.44M

The floppy drive type option informs the BIOS which drives are connected. The BIOS can detect the presence of floppy drives, but not the type. A typical floppy drive is 1.44M. Setting the 1st Floppy Drive Type to None disables floppy drive support in the BIOS, which conserves power (disabling the floppy device) and speeds the booting process.

*Enable IDE Drive(s)? Y*

Disable IDE Drives if no hard disks will be used in the system. If a hard disk maybe used, it is best to leave this option enabled. Disabling this option will free the IDE IRQ14.

**Serial Options**
*Enable Com2 IRQ 3? Y*

Disable this option to free IRQ 3 for uses other than Com2 serial I/O. Com2 remains enabled as a serial port, but for polled mode only.

*Enable Com3 IRQ 10? Y*

Disable this option to free IRQ 10 for uses other than Com3 serial I/O. Com3 remains enabled as a serial port, but for polled mode only.

*Display/Change Console Port? Y*

      Current Console Port: Com1
      N = None, 1 = Com1, 2 = Com2
This option is relevant only when the Video Order 1 option is set to Serial Console.

*Display/Change Console Baud Rate? Y*

      Current Console Baud Rate: 19200
      A = 2400, B = 9600, C = 19200, D = 57600, E = 115K
This option is relevant only when the Video Order 1 option is set to Serial Console.

*Display/Change Console Port IRQ? Y*

      Current Console Port IRQ: PC-Standard
      A = PC-Standard, B = IRQ5, C = IRQ9, D = IRQ11
This option is relevant only when the Video Order 1 option is set to Serial Console.

*Enable Int14h Access to Console Port? N*

When the serial console port is enabled, the BIOS disables access to that port from normal BIOS serial services (Int 14h). For example, if the serial console port is set to Com1, DOS will no longer see that serial port as Com1. Instead, DOS will see the port labelled Com2 as COM1. This option is relevant only when the Video Order 1 option is set to Serial Console.

**Video Options**
*Display/Change Video Order 1?*

      Current Video Order 1: BIOS Extension (VGA)
      N = None, 1 = BIOS Extension (VGA), 2 = Serial Console
Video order 1 defines the primary video source. If the Serial Console is chosen, this also affects the primary keyboard source.

*Display/Change Video Order 2?*

      Current Video Order 2: BIOS Extension (VGA)
      N = None, 1 = BIOS Extension (VGA), 2 = Serial Console
Video order 2 defines the video source if the primary one is not found. For example, if the Video BIOS was erased from the Boot Flash, then this video source would be used.

*Select LCD Panel?*

      Current LCD Panel: Default (VGA)

      A=Default (VGA)          B=

**NOTE: Care should be taken when selecting a flat panel, (make sure it is the correct BIOS for the required display. The panel could sustain serious damage, if used with the wrong BIOS configuration)**

For More information please refer to the VIDDIFF section below.

**Printer Options**
*Display/Change Printer Port Mode? Y*

> Current Printer Port Mode: PC/AT
> 1 = PC/AT, 2 = PS/2, 3 = EPP, 4 = ECP, 5 = EPP&ECP

*Display/Change Printer Port IRQ? Y*

> Printer Port IRQ: Disabled
> N = Disabled, 5 = IRQ5, 7 = IRQ7

*Display/Change Printer Port DMA? Y*

> Printer Port DMA: None

**Power Settings**
*Display/Change CPU Speed? Y*

> Current CPU Speed: 99Mhz
> A = 8MHz, B = 16MHz, C = 33MHz, D = 66MHz, E =99MHz

The CPU speed is set to best performance (99MHz) by default. Set the CPU speed lower to reduce power consumption and temperature of the CPU.

**Miscellaneous Options**
*Enable PS2 Mouse? N*

Disabling the PS/2 mouse will enhance the boot speed by 3 - 4 seconds.

*Enable Fast Boot? N*

Fast boot will remove the delay for entering set-up, which will enhance the boot speed by 1 - 2 seconds. This option does not stop you from entering set-up.

Enable Splash Screen? N

The Splash Screen prevents the initial BIOS sign-on from appearing, making the computer appear to be less like a PC, The BIOS will display a 320x200 Bit-map Image. See the next section on Splash Screen for further information.

Display/Change Data/Time? N

> Current date 10-01-2000

> Enter new date (e.g. 11-27-1999):

> Current Time 01:22:32

> Enter new time (e.g. 14:57):

*Change Password? N*

Entering a password prevents unauthorised access to the computer. If set, the BIOS will ask for a password each time it boots the system, and will refuse to enter set-up or boot without the proper password. The password can be up to 7 ASCII characters in length.  To remove the password, choose this option and enter nothing for the new password (just press Enter).

## Exit Menu
Save changes and exit or Quit (S, Q)?
Saving changes will reboot the system to allow the changes to take place immediately. Quitting without saving will abort all the changes made during this set-up session.

## Splash Screen
The Splash Screen feature allows most Int 10h (BIOS Video) calls to be temporarily disabled, thus blocking output to the screen, while displaying a stored image on screen. This stored image could be a blank screen or a company Logo. When the user application has loaded the splash screen can be disabled via Int 15h function 20DB.

Int 15h

call with:      AX=20DBh
                CX=0

Returns: Splash screen disabled, normal Int 10h activity can resume.

Ansi.sys and other programs, which write directly to the video buffer, are not compatible with the Splash Screen feature.  They may cause the console to behave in an unpredictable manner.

As default, the Splash screen is the Arcom Control Systems logo. To change this you will first need to generate a new picture. This needs to be a RLE8 format bit-mapped image, with a resolution of 320x200 and 256 colours, and a maximum size of 20K. Copy the contents of the /BIOS directory on the CD-ROM to your host PC's Harddisk, and store this new picture in the same directory. To generate the new BIOS image run:

C:\>splash splash.bmp dlbios.img new.img

This generates the new BIOS image 'new.img' containing the new splash screen image 'splash.bmp'. To use this new BIOS image refer to the EBIOS section below. The splash program also verifies the new splash image, to make sure that the image is the correct size and type.

### VIDDIFF
The BIOS has the ability to load different video BIOS, to support other flat panel's.

The 'VIDDIFF' utility is used to add more flat panel configurations to the BIOS flat panel switching.
To add a new panel, firstly copy the /BIOS directory on the CD-ROM to your host PC's and place your new flat panel BIOS (*.dat) in the same directory. Then run 'viddiff':

C:\>Viddiff ↵

This will search the directory for all *.dat files, and ask you to give a description for each one. When the list is complete, a viddiff.bin file is created. You next need to include this file in your BIOS image this is done by using 'promerge':

C:\>promerge new.img 128K dlbios.img -128K viddiff.bin 46K /o
This generates the new BIOS image 'new.img' containing the new flat panel configuration/s. To use this new BIOS image refer to the EBIOS section below.
**NOTE**
**The flat panel BIOS must be a 40K in size and saved with a '.DAT' extension. Refer to the Chips 65550 documentation on the CD-ROM, for more information on configuring flat panels.**

## Changing the CMOS Defaults

A utility called CMOS2IMG.EXE' is supplied on the support CD. This utility allows you to change the default CMOS settings in the Datalight BIOS. This will make sure that the board will always boot in the required configuration, even if the battery fails or is not fitted.

This operation has to be carried out on the ELAN-104NC board. Copy the 'dlbios.img' and 'cmos2img.exe' (both can be found in the /BIOS directory of the ELAN-104NC CD-ROM) to the ELAN-104NC. Now run 'cmos2img.exe'

C:\>cmos2img new.img dlbios.img ↵

Where 'new.img' is the new BIOS image file to be written to the board using 'EBIOS'.

## EBIOS

**WARNING!**

**Take extreme care when carrying out a BIOS update, do not attempt to stop the update while it is in progress, as the BIOS ROM could become corrupted and the board will not boot. Also check that the new BIOS image is 128K in size before running 'EBIOS'.**

To write your new BIOS image in to the ELAN-104NC, copy 'ebios.exe' (in the /BIOS directory of the ELAN-104NC CD-ROM) and your new BIOS image to your ELAN-104NC. Now run 'ebios.exe'

C:\>ebios new.img ↵

Where 'new.img' is the new BIOS image file to be written to the board.

# Software Support

The development kit contains a support CD-ROM that incorporates reference material and software utilities that can be used to support the ELAN-104NC. The following sections describe the software support and provide guidelines for using the drivers supplied on the CD.

## Datalight ROM-DOS 6.22

The ELAN-104NC board is supplied with a license for Datalight's ROM-DOS 6.22 operating system. This operating system is pre-installed on the flash drive. The support CD-ROM can be used to generate a bootable ROM-DOS floppy disk if required.

ROM-DOS is a Microsoft MS-DOS compatible operating system that has been specifically designed for embedded systems. The system and command files are much smaller, but still provide full compatibility to allow standard DOS applications to run without modification. ROM-DOS supports all the standard utility programs like SYS, PRINT, MODE, FDISK, FORMAT etc. These programs are supplied on the support CD-ROM and can be used as required.

A full user manual for ROM-DOS is also supplied on the CD. This provides detailed information on the operating system and features.

## Datalight FlashFX Wear Levelling Flash Filing System

The flash memory incorporated onto the ELAN-104NC is configured as a silicon read/write disk drive. This disk is supported using Datalight's FlashFX software. This software is designed to enable the disk to be accessed using standard DOS routines. The FlashFX software is installed as a BIOS extension. This enables the flash disk to be used as a boot disk and this will be the default boot device if a hard disk drive is not present in the system. When shipped, the flash memory is formatted and configured as a ROM-DOS bootable disk.

The FlashFX software has been designed to incorporate wear-levelling algorithms. The wear levelling ensures that the flash memory is used evenly and that no one sectors is continually being erased. This enables the life span of the flash device to be maximised.

The support CD contains utilities that can be used to ensure that the flash disk is configured correctly (See the README file in the FlashFX section of the support CD-ROM). In the unlikely event of the flash disk becoming corrupted, these utilities can be used to reformat the flash. The 'bootdisk' provides an automatic mechanism for reformatting the flash memory and installing the ROM-DOS operating system.

## EBIOS Utility

The EBIOS utility provides users with the ability to update the BIOS used on the board. This may be required if you experience any incompatibilities with the BIOS and a later version is available. The main reason for using this utility however is to allow the VGA BIOS to be configured for your particular choice of flat panel display.

The VGA BIOS has been incorporated into the system BIOS flash device. The VGA BIOS is configured for a particular mode of operation and must be modified to match your requirements. The support CD-ROM contains pre-built BIOS images for flat panel displays that have been configured by Arcom Control Systems. The CD also contains connection details for each panel (Refer to the README file in the \BIOS directory on the CD for the latest list of flat panel displays).

Each BIOS image is 128K bytes in size and contains the complete BIOS code. The EBIOS utility can be invoked from the DOS command line and should be supplied with the BIOS

image file name required i.e. EBIOS CS0:0 BIOS1.BIN. The program will automatically load the file and reprogram the BIOS ROM. After the device has been reprogrammed you should power down the system.

**Note:** During this process it is important that you do not switch off the board as this may cause the BIOS ROM to be corrupted and this will stop the board from operating.

## Bootdisk
The CD-ROM contains a ROM-DOS bootdisk image. The image is stored in the '\BOOTDISK' directory and can be loaded onto a blank floppy disk using the FLWRITE utility that is also in this directory (Refer to the README file for the latest information). A blank formatted 1.44Mb disk should be used for bootdisk creation.

The bootdisk can be used to load the ROM-DOS operating system from a floppy disk drive. A menu is provided once the board has started to boot to allow you to perform certain pre-defined operations. These include booting ROM-DOS, reprogramming the BIOS using EBIOS, reformatting the flash disk and copying the system files to the flash disk i.e. making the flash disk bootable. Once the appropriate selection has been made the software will perform the operation automatically.

## Operating System Drivers
The support CD contains drivers for the Intel/Chips and Technologies 65550 VGA controller and RealTek ethernet controller. The following sections provide details for installing these drivers for Windows 95.

Windows 95 Driver Support
Install Windows 95 as detailed in the Windows documentation. When prompted do not select a network adapter, sound or video card driver. Once the operating system has completed installation follow the steps detailed below to install each driver:-

## Installing the Chips HiQ 65550 Video driver
Using the Run command on the Start menu select the following file from the support CD-ROM

D:\CHIPS 65550 Video Controller\Windows 95\Standard\W95500.EXE

Follow the prompts and restart windows to enable the driver.

The driver detailed above is the standard Windows 95 driver. An alternative driver which provides support for multiple orientations i.e. Portrait mode is also available. To use this driver:-

1. Select Windows 95 display properties from the system Icon in 'Control Panel'.

2. Select 'Settings' -> 'Advanced'.

3. Click on Adapter type 'Change' and select 'Have disk'.

4. Enter the path D:\CHIPS 65550 Video Controller\Windows 95\Portrait

5. Load the chips95.inf file.

6. Choose NOT to keep all files that are newer than those being installed.

7. Restart Windows

## Installing the RealTek Ethernet drivers

Choose ISA Ethernet Controller from the system icon in 'Control Panel'. Select properties and driver. Select update driver. When the driver is not detected select 'Other location', insert the support CD in the drive and enter:

D:\Ethernet\Win95

When prompted for the RealTek disk enter

D:\Ethernet\Win95

The Windows 95 installation CD may be required to complete installation.

## Flat Panel Support

The default ELAN-104NC VGA BIOS has the flat panel output configured for the NEC NL6448ACxx-xx range of displays. The NL6448BC20-08 is supplied (optionally) with the ELAN-104NC Development Kit. For other types of display, the BIOS will need to be modified to configure the device correctly. Suitable BIOS image files for your display may be available on the Development Kit CD or from Technical Support at Arcom Control Systems. Editing Utilities are supplied on the CD. See the EBIOS description earlier in this section and the BIOS section, for more details.

## Other Software Support

The support CD-ROM also contains the following material:-

1. Microsoft Internet Explorer 5.0
2. Mitsumi Mouse Driver (For DOS)
3. Adobe Acrobat Reader 4.0
4. Example source code for:-
   - General Purpose I/O (driving 4x4 matrix keypad)
   - RS485/422 Serial Communications.
   - Watchdog
   - Power Management

Please refer to the documentation on the CD-ROM for the latest information.

## Hardware Support Information

As the ELAN-104NC is a fully PC/AT compatible processor board any standard PC reference guide will provide information on hardware aspects of the board. The following material has been included on the support CD-ROM as it relates to specific features of the board. This information is stored in the '\REFERENCE' directory:-

1. AMD Elan SC400 Data Sheet, Register Sets and User Manual.
2. Intel/Chips and Technologies 65550 data sheet, OEM reference guide and application notes
3. SMSC 37C932 Super I/O Controller Data Sheet
4. RealTek RTL8019AS Data Sheet.
5. Intel Strata Flash Data Sheet.
6. PC/104 Specification.

If you are trying to locate information on a specific function that is not included above then refer to Appendix D which contains references to some relevant internet sites. Please refer to the documentation on the CD-ROM for the latest information.

# Detailed Hardware Description

The following section provides a detailed description of the functions provided by the ELAN-104NC. This information may be required during development once you have started adding extra peripherals or are starting to use some of the embedded features of the board.

## Processor

The AMD Elan (SC400) processor is an Am486 class processor without a floating-point unit. It has been designed to provide a low power, low cost fully integrated PC/AT compatible architecture. The SC400 is a 32-bit x86 compatible device and has 8K L1 write-back cache integrated into the processor. A 100MHz part is used on the ELAN-104NC.

The processor has a single supply rail and is powered from +3.3V. This voltage is generated on the ELAN-104NC from the main +5V supply input.

The SC400 processor is packaged in a 256 pin Ball Grid Array. The SC400 processor is a low power device and no heatsink is required for this device on the ELAN-104NC. Without a heatsink the processor can operate at ambient temperatures up to 70°C (when run at 66MHz or less) or 50°C (when running at 100MHz). Refer to Appendix F, Thermal Consideration for operation at 100Mhz up to 70°C ambient.

## Memory

The ELAN-104NC supports four types of memory device, the system memory that is provided by EDO DRAM, the BIOS EEPROM, the Flash array and the (battery backed) SRAM.

## EDO DRAM

There are two variants of the board. One is fitted with 4MB of DRAM, the other 16MB of DRAM. These are surface mount devices soldered to the board and cannot be upgraded. The Datalight BIOS automatically detects the amount of memory fitted to the board.

## BIOS EPROM

A 128Kbyte flash EPROM device is used to store the BIOS code. This device can be reprogrammed in situ using the EBIOS utility supplied on the support CD-ROM. (See the Software Support Section for details.) The system BIOS is copied into shadow RAM between 0E0000H and 0FFFFFH and the VGA BIOS is copied into shadow RAM to 0C0000H.

The flash device is a +5V only device and there are no link settings required to enable programming.

## Flash Memory/Silicon Disk

The ELAN-104NC board supports up to 8MB flash memory. This memory is configured as a wear levelling read/write silicon disk drive. The Datalight FlashFX flash filing system will automatically be loaded to enable the flash drive to be accessed. The flash drive uses a 32KB memory window at 0B0000-0B7FFF to access the device and two I/O address locations are used to select the appropriate flash area. The FLASH status LED will illuminate whenever the Flash drive is accessed.

## Battery Backed SRAM

The ELAN-104NC board has a 128kb SRAM device on board. This device can be used as a high speed drive using the device drive 'SRAMDRIVE.SYS' which can be found on the CD-ROM. The SRAM is backed up by the on-board battery.

## Memory Map

The following table shows the memory map for the ELAN-104NC.

| Address | Block Size | Description |
|---|---|---|
| 400000h - | 12MB | Optional extra 12MB DRAM accessed as extended or EMS Memory |
| 100000h – 3FFFFFh | 3MB | 3MB DRAM accessed as extended or EMS Memory |
| 0E0000h – 0FFFFFh | 128K | PC BIOS |
| 0DC000h – 0DFFFFh | 16K | SRAM Window (to 128K SRAM) (If using SRAMDISKSYS) |
| 0D0000h – 0DBFFFh | 48K | PC/104 Memory Window |
| 0CC000h – 0CFFFFh | 16K | FlashFX BIOS extension |
| 0C0000h – 0CBFFFh | 48K | VGA BIOS (32K / 40K) |
| 0B8000h – 0BFFFFh | 32K | VGA Memory |
| 0B0000h – 0B7FFFh | 32K | Flash Memory Window |
| 0A0000h – 0AFFFFh | 64K | VGA Memory |
| 000000h – 009FFFh | 640K | System DRAM |

The PC/AT I/O address map is limited to 1K addresses. This is because only the lower ten address lines were originally used to decode I/O devices. The remaining lines were treated as undefined. Therefore the usable address range is 0-3FFH. Above this range, devices are mirrored throughout the entire 64K I/O address range of the processor.

The following table shows the I/O address mapping for the ELAN-104NC. If expansion boards are added via the PC/104 interface you should ensure that they are configured to be at a free address location. Otherwise they will not function correctly and may even cause the ELAN-104NC board to stop operating.

| Device | I/O Location (Hex) |
|---|---|
| COM1 | 3F8-3FF |
| Floppy Disk | 3F0-3F7 |
| COM3 | 3E8-3EF |
| Reserved I/O space | 3E2-3E7 |
| PC Card | 3E0-3E1 |
| Video Controller (MONO) | 3B0-3DF |
| Reserved I/O space | 380-3AF |
| Parallel Port | 378-37F |
| Network Controller | 300-31F |
| COM2 | 2F8-2FF |
| SuperIO watchdog trigger | 200-201 |
| Available for PC/104 | 1F8-1FF |
| IDE controller | 1F0-1F7 |
| Alternate CPU Reset Control | 0EF |
| Alternate A20 Gate Control | 0EE |
| Master DMA (DMA0) | 0C0-0DF |
| Interrupt Controller 2 | 0A0-0A1 |
| System Control Port A | 092 |
| General Registers / DMA Page Registers | 080-08F |
| Real Time Clock | 070-071 |
| Keyboard/Mouse | 060-064 |
| Programmable Interval Timer (PIT) | 040-043 |
| Chip Setup and Control (CSC) | 022-023 |
| Master Interrupt Controller | 020-021 |
| Slave DMA (DMA1) | 000-00F |

## Graphics Controller

An Chips and Technologies 65550 HiQVideo graphics controller is integrated onto the ELAN-104NC. This device is used to provide a high-performance flat panel/CRT video controller.
The flat panel display output can be used to support monochrome single scan STN, dual scan STN, TFT, EL and Plasma displays. The TFT output can be used to support up to 24-bit displays.

The 65550 graphics controller is supported by 1MB of EDO DRAM. This memory is used to support the standard VGA frame buffer and can be used to provide an extra buffer when driving a dual scan panel to synchronise the display data.

The following table shows the video resolutions supported by the 65550 with the corresponding number of bits per pixel.

| Resolution | Bit Per Pixel |
|------------|---------------|
| 640 x 480 | 8/16/24 |
| 800 x 600 | 8/16/24 |
| 1024 x 768 | 8/16 |

The flat panel and CRT interface signals are routed to two separate connectors. Both displays can be driven simultaneously.  The ability to drive both displays is dependent on the particular timing parameters of the flat panel display. It is not always possible to select appropriate clock rates to achieve an output on both the CRT and flat panel displays. There are three utilities located in the "\CHIPs 65550 Video Controller\Mode Switching Utilities" directory, which allow you to change which video interface is enabled. They are:

'SM.COM'        -Flat Panel and CRT Interfaces enabled simultaneously.
'FP.COM'        - Flat Panel Interface enabled only.
'CRT.COM'       - CRT Interface enabled only.

The CRT output signals are routed to a 16-way 0.1" boxed header PL11. These signals will normally be connected directly to a VGA compatible CRT monitor. A suitable cable is provided as part of the ELAN-104NC development kit. The following table shows the connection details for this cable. The CRT signals may be affected by noise and therefore this cable should be kept as short as possible and should be routed away from other signals to stop any crosstalk.

| PL21 Pin | Signal Name | 15 way D-Type High Density |
|----------|-------------|----------------------------|
| 1 | RED | 1 |
| 2 | Red Ground | 6 |
| 3 | GREEN | 2 |
| 4 | No Connection | 4 |
| 5 | BLUE | 3 |
| 6 | Green Ground | 7 |
| 7 | No Connection | 9 |
| 8 | No Connection | 11 |
| 9 | Blue Ground | 8 |
| 10 | Ground | 5 |
| 11 | SYNC Ground | 10 |
| 12 | HSYNC | 13 |
| 13 | No Connection | 12 |
| 14 | VSYNC | 14 |
| 15 | No Connection | 15 |
| 16 | No Connection | - |

The Flat panel signals are routed to a 40 way high-density connector (PL1). These signals provide the flat panel data and control signals. The flat panel interface can be configured to drive various types of panel. Each interface redefines the function of the panel data lines.

The following table provides a cross-reference between the flat panel output signals and their function when configured for different displays.

| | Mono SS | Mono DD | Mono DD | Colour TFT | Colour TFT | Colour TFT-HR | Colour STN-SS | Colour STN-SS | Colour STN-DD | Colour STN-DD | Colour STN-DD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pin Name | 8-Bit | 8-Bit | 16-Bit | 9/12/16Bit | 18/24 Bit | 18/24-Bit | 8-Bit (4bp) | 16-Bit (4bp) | 8-Bit (4bp) | 16-Bit (4bp) | 24-Bit |
| P0 | D0 | UD3 | UD7 | B0 | B0 | FB0 | R1 | R1 | UR1 | UR0 | UR0 |
| P1 | D1 | UD2 | UD6 | B1 | B1 | FB1 | B1 | G1 | UG1 | UG0 | UG0 |
| P2 | D2 | UD1 | UD5 | B2 | B2 | FB2 | G2 | B1 | UB1 | UB0 | UB0 |
| P3 | D3 | UD0 | UD4 | B3 | B3 | FB3 | R3 | R2 | UR2 | UR1 | LR0 |
| P4 | D4 | LD3 | UD3 | B4 | B4 | SB0 | B3 | G2 | LR1 | LR0 | LG0 |
| P5 | D5 | LD2 | UD2 | G0 | B5 | SB1 | G4 | B2 | LG1 | LG0 | LB0 |
| P6 | D6 | LD1 | UD1 | G1 | B6 | SB2 | R5 | R3 | LB1 | LB0 | UR1 |
| P7 | D7 | LD0 | UD0 | G2 | B7 | SB3 | B5 | G3 | LR2 | LR1 | UG1 |
| P8 | | | LD7 | G3 | G0 | FG0 | | B3 | | UG1 | UB1 |
| P9 | | | LD6 | G4 | G1 | FG1 | | R4 | | UB1 | LR1 |
| P10 | | | LD5 | G5 | G2 | FG2 | | G4 | | UR2 | LG1 |
| P11 | | | LD4 | R0 | G3 | FG3 | | B4 | | UG2 | LB1 |
| P12 | | | LD3 | R1 | G4 | SG0 | | R5 | | LG1 | UR2 |
| P13 | | | LD2 | R2 | G5 | SG1 | | G5 | | LB1 | UG2 |
| P14 | | | LD1 | R3 | G6 | SG2 | | B5 | | LR2 | UB2 |
| P15 | | | LD0 | R4 | G7 | SG3 | | R6 | | LG2 | LR2 |
| P16 | | | | | R0 | FR0 | | | | | LG2 |
| P17 | | | | | R1 | FR1 | | | | | LB2 |
| P18 | | | | | R2 | FR2 | | | | | UR2 |
| P19 | | | | | R3 | FR3 | | | | | UG3 |
| P20 | | | | | R4 | SR0 | | | | | UB3 |
| P21 | | | | | R5 | SR1 | | | | | LR3 |
| P22 | | | | | R6 | SR2 | | | | | LG3 |
| P23 | | | | | R7 | SR3 | | | | | LB3 |
| SHFCLK | SC | SC | SC | SC | SC | SC | SC | SC | SC | SC | SC |
| Pixels/ Clock | 8 | 8 | 16 | 1 | 1 | 2 | 2-2/3 | 5-1/3 | 2-2/3 | 5/1/3 | 8 |

The display signals are +3.3V compatible, the ELAN-104NC contains power control circuitry for the flat panel logic supply and backlight supply. The flat panel can be supplied with a switched 3.3V or 5V supply depending on the position of LK1. The backlight can also be supplied with a switched supply of 5V or 12V depending on the position of LK11. (See the link section for details. As there is now on board protection for these switched supplies, care should be taken not to draw too much current. (< 750mA ).

The 65550 controls the supply voltages during power up/down to ensure that the panel is not damaged due to the input signals being incorrectly configured.

The flat panel signals are configured by the VGA BIOS during the power up process. The default BIOS is configured to drive the 6.5" NEC TFT panel (NL6448BC20-08) which is supplied as part of the flat panel development kit.  If you are using a different type of panel then the BIOS will need to be modified to configure the device correctly.  The support CD-ROM contains BIOS image files for flat panel displays that have been tested by Arcom Control Systems. See the Software Support section for details. The CD-ROM also contains connection information for each of these displays.

If the display you wish to use in your application is not listed on the CD-ROM, then contact Arcom Control Systems technical support, as the list of displays is continually updated.

The support CD-ROM contains drivers for Windows 3.11 and Windows 95. Other drivers may be available from the Intel Internet site at www.intel.com. The drivers supplied can be used to support standard video orientation as well as portrait mode.

# Interrupts

| Internal SC400 IRQ | | Function | Source |
|---|---|---|---|
| **Master ICU** | IRQ0 | Timer Tick | Elan SC400 |
| | IRQ1 | Keyboard | Super I/O |
| | IRQ2 | Slave ICU Cascade | Elan SC400 |
| | IRQ3 | COM2 | Super I/O |
| | IRQ4 | COM1 | Super I/O |
| | IRQ5 | Ethernet | RTL8019AS |
| | IRQ6 | Floppy Disk | Super I/O |
| | IRQ7 | Parallel Port | Super I/O |
| **Slave ICU** | IRQ8 | Real Time Clock | Elan SC400 |
| | IRQ9 | Cascaded IRQ2 | - |
| | IRQ10 | COM3 | Elan SC400 |
| | IRQ11 | Available | - |
| | IRQ12 | PS/2 Mouse | Super I/O |
| | IRQ13 | Not Available | - |
| | IRQ14 | IDE Drive | Super I/O |
| | IRQ15 | Available | - |

These IRQ's are only available to devices external to the Elan SC400 if they are configured to use one of the eight external interrupt pins of the Elan SC400 (PIRQ0-7).

The Elan SC400 has eight external programmable interrupt pins (PIRQ0-7). Each of these pins is programmable to correspond to one of the Elan SC400 internal interrupts (IRQ1, IRQ3-IRQ15). For further information please refer to the AMD Elan SC400 Microcontroller User Manual. The Elan SC400 internal interrupts are configured to correspond to the interrupts available in the PC/AT system.

The external interrupt pins (PIRQ0-7) of the Elan SC400 are connected to the PC/104 interface and the SMSC FDC37C932 SuperIO controller. The table below shows the connections and default programming for the interrupts.

| Elan SC400 Internal Interrupt | Elan SC400 External Interrupt Pin | PC/104 Interface | SuperIO Interrupt Pin | Network Controller (ISA assignment) | Usage |
|---|---|---|---|---|---|
| IRQ14 | PIRQ0 | IRQ14 | IRQ14 | INT6 (IRQ12) | IDE Disk Drive |
| IRQ1 | PIRQ1 | IRQ15 | IRQ1 | INT7 (IRQ15) | Keyboard |
| IRQ12 | PIRQ2 | IRQ9 | IRQ12 | INT0 (IRQ2/9) | Mouse |
| IRQ3 | PIRQ3 | IRQ3 | IRQ3 | INT1 (IRQ3) | COM2 |
| IRQ10 | PIRQ4 | IRQ4 | IRQ10 | INT2 (IRQ4) | COM3 |
| IRQ5 | PIRQ5 | IRQ5, IRQ10 | - | INT3 (IRQ5) | Network |
| IRQ6 | PIRQ6 | IRQ6, IRQ11 | IRQ6 | INT4 (IRQ10) | Floppy Disk |
| IRQ7 | PIRQ7 | IRQ7, IRQ12 | IRQ7 | INT5 (IRQ11) | Printer (LPT)* |
| IRQ4 | - | - | - | - | COM1 |
| IRQ8 | - | - | - | - | Real Time Clock |
| IRQ0 | - | - | - | - | Interval Timer |
| IRQ2 | - | - | - | - | Slave ICU Cascade |
| IRQ9 | - | - | - | - | Cascaded IRQ2 |
| IRQ11 | - | - | - | - | - |
| IRQ13 | - | - | - | - | Not Available |
| IRQ15 | - | - | - | - | - |

These IRQ signals are routed to the PC/104 interface as well as the onboard devices.  PC/104 boards can only use these signals if they are unassigned or the onboard device is disabled. Before using these interrupts check that the appropriate line is not already configured for another device.

**\*Note:** In the default BIOS set-up, the parallel port interrupt, IRQ7, is programmed as not selected on the SuperIO controller. Thus a PC/104 add-on card may use IRQ7 without any changes to the interrupt settings. If an interrupt is required for the printer port, this setting should be changed in the BIOS set-up. See the BIOS Set-up Section for how to do this.

## DMA Controller
There are two 8237A compatible DMA controllers internal to the Elan SC400. These controllers are cascaded in a standard PC/AT style and provide seven user DMA channels. There are four 8-bit channels and three 16-bit channels.

Any two of the seven channels can be mapped to the two external DMA request/acknowledge lines provided by the Elan SC400. The table below shows the default assignment for the DMA channels on the ELAN-104NC.

| DMA | Usage | External Channel |
|---|---|---|
| 0 | Floppy Disk Drive | PRDQ0 / PDACK0# |
| 1 | Unassigned | |
| 2 | Unassigned | |
| 3 | Parallel Port (ECP Mode) | PRDQ1 / PDACK1# |
| 4 | Unassigned | |
| 5 | Unassigned | |
| 6 | Unassigned | |

The two external DMA channels of the Elan SC400 are connected to DMA channels 0 and 1. The DMA signals are routed to the PC/104 interface as well as to the onboard devices. They may only be used by PC/104 peripherals if the onboard peripheral is disabled.

## IDE Interface

The ELAN-104NC has a single Integrated Drive Electronics (IDE) controller that supports up to two hard disk drives. The disk drives are connected via a 1:1 40-way ribbon cable using PL8. One drive must be configured as a 'MASTER' and the other drive as a 'SLAVE'. An IDE compatible CD-ROM drive can also be used and should be configured as the 'SLAVE' device.

The default BIOS set-up is for automatic detection and controller configuration of devices connected to this interface. The BIOS can be configured to make either the hard disk drive or the floppy disk drive the default boot device.

If a hard disk drive is attached to this interface the default configuration will cause the drive to be used as the standard boot device and the flash disk if present will become the next available drive.

## Floppy Disk Controller

The floppy disk interface is designed to support up to two standard floppy disk drives. Connections are made via a 34-way 0.1" boxed header PL9. (See Appendix A for pin assignment details.) All standard capacities including 360KB, 720KB, 1.2MB and 1.44MB are supported. The BIOS must be configured appropriately for the desired format using the set-up program. The default BIOS configuration is for no floppy drive connected.

The floppy disk drive cable should have three connectors, two which are connected directly 1:1 and one which has pins 10-16 twisted.  If only one drive is required it should be connected via the twisted cable and the drive should be set-up to use drive select 2 (i.e. DS1).  If two drives are required the second drive should also be configured for drive select 2 but should be connected via the straight connector. This connection does not provide power and therefore a separate cable from the main supply should be used.

The floppy disk interface is decoded in I/O address space at 3F0-3F7H and uses IRQ6 and DMA channel 0.

## Real Time Clock

The ELAN-104NC uses the Real Time Clock internal to the Elan SC400. It is fully compatible with the MC146818A standard clock device used in PC/AT systems. The date and time functions are stored in the real time clock when the main power is removed if the battery backup supply is enabled (See LK10 description). The Real Time Clock is decoded in I/O address space at 70-71H. The Real Time Clock registers are accessed via an indexed addressing mechanism. I/O location 70h is used to select the appropriate register and location 71H is used to access the data. See the Elan SC400 Microcontroller Register Set Reference Manual for further details.

The Real Time Clock and CMOS settings are maintained by the battery backup circuit when the main power input is disconnected.  A lithium cell provides the battery backup supply and has a capacity of 170 mAH. This battery will provide sufficient support for at least 3 years continuous backup.  The battery is disabled during shipment to prolong its useful life.  If the board is going to be placed out of service for long periods of time then the battery should also be disabled.  If the main supply is present on the board the battery is automatically disconnected from the Real Time Clock circuitry.

The accuracy of the Real Time Clock is based on the operation of the 32.768KHz watch

crystal. This will provide an accuracy of +/- 1 minute per month if the board is in an ambient environment of +25°C. When the board is operated outside this temperature the accuracy may be degraded.

## Keyboard/Mouse Controller

The SMSC FDC37C932 SuperIO controller provides support for a standard PC/AT keyboard and mouse. Both interfaces use a 6-pin mini-DIN style connector, the keyboard is connected via PL4 and mouse via PL16. The keyboard controller is decoded at I/O address location 60-64H and uses IRQ1 for keyboard and IRQ12 for mouse support. Power for the keyboard and mouse is sourced from the +5V supply.

The development kit is supplied with a PS/2 to AT adapter cable that can be used to convert between the mini-DIN connector and the standard AT style keyboard connector. The development kit also contains a PS/2 mouse that will plug directly into PL16.

The Datalight BIOS will automatically detect the presence of the keyboard and mouse and provide support.  If these devices are not plugged in the BIOS will continue to operate correctly.

## Ethernet Controller

A RealTek RTL8019AS ethernet controller provides a 10-BaseT interface. This is a 16-bit ISA device that is configured by the BIOS during power ON. The device provides compliance with IEEE802.3 10BaseT specification and IEEE 802.3 Full Duplex Flow Control. A 93C46 EEPROM is used to store configuration data and ID information.

An 8-way RJ45 connector is used to provide signals. See Appendix A for pin assignment details.

A second connector PL10 also provides users with status signals that are designed to drive LED's.  The status lines provide TX, RX and LINK status. The output lines sink current when switched on therefore the anode of each device should be connector to PL10 pin 1 and the cathode to the appropriate status line.

The support CD-ROM contains drivers for most operating systems and network software. These are stored in the ETHERNET directory.

## Watchdog Timers

The ELAN-104NC contains 2 independent watchdog timers, which can be used to protect against application software conditions which may cause the ELAN-104NC to 'hang'. The watchdog timers, once started, will trigger a CPU reset if they are not re-triggered within a set timeout period. There is a hardware watchdog reset and a watchdog supported by the SuperIO controller (SMSC FDC37C932).

For the hardware watchdog, there are two timeout periods available. The timeout is either 2 or 8 seconds (±200ms) depending on the position of LK7. The watchdog timer is disabled by a RESET and can be started by setting and then clearing bit 1 of index register A8h of I/O location 22h/23h. This address corresponds to the Elan SC400 general purpose I/O line GPIO17.  See the AMD Elan SC400 Microcontroller Register Set Reference Manual for further details. If another set and reset of this location is not performed within the timeout period the board will be RESET. Accesses to the trigger must be continually performed to enable the board to function correctly; there is no software-disable mechanism once the timer is started.

The hardware watchdog timer can be disabled permanently by removing link LK9. This feature may be useful during debug/development.

The SuperIO device (FDC37C932) contains a Real Time Clock module, which is not used. (The ELAN-104NC uses the Real Time Clock internal to the Elan SC400.)  The SuperIO Real Time Clock must be enabled to allow the SuperIO watchdog timer to operate. The example code on the Development Kit CD demonstrates how to enable this device. The SuperIO watchdog timer can be disabled permanently by removing link LK8.  This feature may be useful during debug/development.

The SuperIO watchdog can be set to have a timeout period from 1minute to 255 minutes. The SuperIO watchdog must be set-up and initialised by the user's own code.  The Development Kit CD contains example code that shows how this can be achieved. The watchdog timer is re-triggered by reading from the "Joystick Port" at I/O address 0x201. As with the hardware watchdog, if no read is performed on this address within the timeout period, a CPU reset will occur.

## User Link

LK2 of the ELAN-104NC is a user link. The status of this user link can be read via the chip set-up and control (CSC) indexed registers at I/O addresses 22h/23h (Index A7).  If the link is fitted then the bit will be read as logic '0' (see the link section for further details). This link does not have any defined function on the board and therefore can be used to select options in the application program.

## General Purpose I/O

Eight general-purpose I/O lines are provided on the ELAN-104NC. These lines are unbuffered and are routed to the 10-way 0.1" header PL2.  These lines are driven directly from the ELAN SC400 device; the lines are driven to 3.3V and are capable of driving ±18mA max.

The eight I/O lines are connected to GPIO lines from the Elan SC400. The table below shows the relationship between the GPIO lines on the Elan SC400 and the I/O lines on PL2.

| Elan SC400 GPIO Line | PL2 GPIO Line |
|---|---|
| GPIO24 | GPIO0 |
| GPIO25 | GPIO1 |
| GPIO26 | GPIO2 |
| GPIO27 | GPIO3 |
| GPIO28 | GPIO4 |
| GPIO29 | GPIO5 |
| GPIO30 | GPIO6 |
| GPIO31 | GPIO7 |

The Development Kit CD-ROM contains some example 'C' source code for using these lines to operate a 4 x 4 matrix keypad.

## PC/104 Interface

The PC/104 interface supports 8/16 bit ISA style PC/104 signals.  Add-on boards can be used to enhance the functionality of the main board.  A large number of companies have adopted the PC/104 standard and boards are available which support a wide range of interfaces. This bus can be used to add digital I/O, analogue I/O, serial ports, video capture devices, PC CARD interfaces, motion control devices etc.

Any board plugged into this interface will be accessed as if it were part of the main board. Therefore it may conflict with I/O and memory devices onboard - if it has not been correctly

configured. Before using an expansion board you should check that it can be configured to work alongside the peripherals already incorporated onboard.

The PC/104 bus signals are fully compatible with the ISA bus electrical timing definitions. Some IRQ and DMA signal lines may be associated with onboard devices and are therefore are not to be used by add-on boards.

## Serial Ports

There are three high-speed 16550 serial UART's on the ELAN-104NC. Both RS232 channels are fully software compatible with the 16550 and can be used as standard RS232 serial interfaces.  COM1 (RS232) is supported by the Elan SC400 device, COM2 (RS232) and COM3 (RS422/485) are supported by the SuperIO FDC37C932 device. The table below shows the configuration for each channel.

### RS422/485 Interfaces

| Port | I/O Address | Elan SC400 internal IRQ | | Connector |
|------|-------------|-------------------------|----------|-----------|
| COM1 | 3F8-3FFH | IRQ4 | RS232 | PL7 |
| COM2 | 2F8-2FFH | IRQ3 | RS232 | PL14 |
| COM3 | 3E8-3EFH | IRQ10 | RS422/485 | PL3 |

The COM3 serial interface can be used to support RS422 or RS485 interfaces. The default link configuration has been selected to enable COM3 as RS485 with a 120 ohm line termination resistor connected.

The RS422/485 signals are routed to a 10-way 0.1" boxed header, which is designed to provide direct connection to 9 way D-type plugs. The serial ports provide support for various baud rates up to a maximum of 115Kbaud. The receive and the transmit line pairs have 1K pull-apart resistors connected.

### RS422

The RS422 interface provides full duplex communication. The signals available are TXA, TXB, RXA, RXB and Ground. The maximum cable length for an RS422 system is 1200m (4000ft) and it supports 1 driver and up to 10 receivers. To enable RS422 operation links LK5 and LK6 should be in position B and the RTS line of COM3 should be at logic '0'.  Links LK3 and LK4 should be made (to connect the 120Ω line termination resistors) if the board is at either end of the network.

### RS485

RS485 is a half-duplex interface that provides combined TX and RX signals. PL3 pin 5 provides TXB/RXB and pin 6 provides TXA/RXA.  A ground connection (Pin 4) is also required for this interface. The maximum cable length for RS485 is the same as RS422 (4000ft), but RS485 supports up to 32 transmitters and receivers on a single network. Only one transmitter should be switched on at a time.

The ELAN-104NC uses the RTS signal to control transmission. When this signal is at logic '1', the driver is switched off and data can be received from other devices. When the RTS line is at logic '0', the driver is on. Any data that is transmitted from the ELAN-104NC will be automatically echoed back to the receiver. This enables the serial communications software to detect that all data has been sent and disable the driver when required. Links LK5 and LK6 should be in position A to the enable RS485 interface.  Links LK3 and LK4 should be made (to connect the 120Ω line termination resistors) if the ELAN-104NC is at either end of the network. The differences between each of the configurations are illustrated below:

| RS422 Point-point | RS422 Multi-drop | RS485 |
|---|---|---|
|  |  |  |

| | | | | | |
|---|---|---|---|---|---|
| **Number of Wires** | 5 | **Number of Wires** | 5 | **Number of Wires** | 3 |
| **Transmitters Enabled** | Active RTS | **Transmitters Enabled** | Active RTS | **Transmitters Enabled** | Active RTS |
| **Receivers Enabled** | Always | **Receivers Enabled** | Always | **Receivers Enabled** | Always |
| **Duplex Mode** | full | **Duplex Mode** | full | **Duplex Mode** | half |
| **LK5** | position B | **LK5** | position B | **LK5** | position A |
| **LK6** | position B | **LK6** | position B | **LK6** | position A |

## Parallel Port

The parallel port is fully IEEE1284 compatible and provides Standard Parallel Port (SPP), Enhanced Parallel Port (EPP) and Extended Capabilities (ECP) support. The parallel port is decoded at I/O address location 378-37FH (LTP1) and uses IRQ7. Note: The default BIOS set-up does not initialise IRQ7 for use by the parallel port. If the parallel port is to be used with interrupts, change the BIOS default settings. See the BIOS set-up section of this manual for more details.

The parallel port has built in protection circuitry to protect against powered devices being connected when the main supply is removed and damaging the device. Each data and control signal is designed to sink 24mA maximum, and source 12mA maximum.

The parallel port connector PL13 is a 26-way 0.1" boxed header. The pin assignment of this connector has been designed to provide 1:1 connection to an IDC 25-way D-Type socket (see Appendix A for details). This socket is compatible with a standard PC parallel port connector. The parallel port can be used to connect an external printer, tape drive, disk drive, scanner etc.

## Power Supply

The ELAN-104NC is designed to operate from a single +5V +/- 5% (4.75V to +5.25V) supply. The power connector PL17 has two ground connections. These connections are commoned on board.  PL17 also has +12V and -12V connections defined. These supplies are not required for the ELAN-104NC under normal operation, but may be used to supply +12V and -12V to the PC/104 stack if required. (E.g. for the AIM104-SER4)

The +5V supply is monitored automatically onboard and if this supply falls below 4.63V the board will be placed in RESET.  When the power supply rises above this threshold voltage the board will start to operate again. This power supply monitor ensures that the board does not hang if the supply voltage fails at any point.

An external battery connection +VBAT is also provided. An external battery can be fitted to provide the battery backup for the BIOS CMOS settings, the Real Time Clock and the SRAM disk drive. The external battery will supply power to the battery backup circuit when there is no +5V supply to the board AND the internal battery is disconnected or the internal battery has a lower voltage than the external battery. **The battery needs to have a voltage of no less than 2.8V and no more than 3.3V**

## Power Management

The Elan SC400 has built in power management. The power management unit can control various aspects of the board. The board can be placed in a power down state and woken using external input from the mouse, keyboard, serial ports, real time clock etc. The power management feature is designed to monitor activity and will start to slow down the CPU and switch off functions if long periods of inactivity are detected. For detailed information on controlling the SC400 power management features, please refer to the 'AMD Elan SC400 Microcontroller Register Set' reference manual.

The ELAN-104NC has a dedicated GPIO (GPIO16) line that can be used to power down the RS232 serial buffers if they are not required. This power down control signal will power down both RS232 serial buffers at the same time. The default configuration for these buffers at power -on is to be enabled (GPIO16=logic'0'). This ensures that the board operates correctly when first powered. Once running the buffers can be disabled during periods of inactivity.

## Power Down

The ELAN-104NC has a dedicated GPI0 line (GPIO15) that can be used to shutdown VGA output when it is not required. The default configuration for this line is for the VGA output to be enabled (GPIO15 = logic '0'). It is important to store the state of the video controller before shutting down. Please refer to the 'vgapwrdn.c' in the examples directory on your CD, or the Chips 65550 documentation.

## Flash LED

There is a single LED on-board, LED1, which illuminates whenever the flash drive is accessed.

## PC Speaker

The on board speaker can be used to notify the user of an error condition during POST or normal operation. The speaker output is controlled by the counter 2 output of the 8254 counter/timer. (Refer to PC software programming guides for more information.). Also an 8 ohm speaker may be connected to PL12.

## Suspend/Resume Switch

A momentary switch connected between pin 1 and 2 of PL6 will cause the board to enter into, or return from, a suspend state when pressed. Pressing this switch during normal operation will

immediately cause the system to enter the suspend state. The suspend state can also be entered under software control. Pressing the switch when already in a suspend state will cause the system to resume.

During suspend, all CPU operations will be halted and the board will be placed in a low power state. Once the board comes out of this state execution will continue from the point where it entered the suspend state.

## RESET Switch
A momentary switch may be connected between pin 1 and 2 of PL19. If the switch is pressed it will cause the CPU (only) to be reset and the BIOS will start executing from the top of memory. This may be useful during development to restart the board if the software crashes.

# Appendix A – Connections

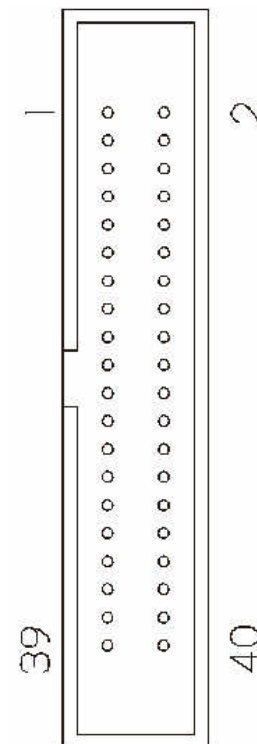| Connector | Description | Mating Connector Type (Part Number) |
|-----------|-------------|-------------------------------------|
| PL1 | VGA Flat Panel Interface | Oupinn 1203-40-GB2* |
| PL2 | General Purpose IO | Standard 0.1" 10-way (2 row) IDC socket |
| PL3 | COM3 RS422/485 Serial Port | Standard 0.1" 10-way (2 row) IDC socket |
| PL4 | PS/2 Keyboard | PS/2 plug |
| PL5 | Ethernet Interface | 8-way RJ45 plug |
| PL6 | Suspend/Resume Header | 2-way Dubox housing (Berg 65240-002)** |
| PL7 | COM1 RS232 Serial Port | Standard 9-way D-type socket |
| PL8 | IDE Interface | Standard 0.1" 40-way (2 row) IDC socket |
| PL9 | Floppy Disk Interface | Standard 0.1" 34-way (2 row) IDC socket |
| PL10 | Ethernet Controller Status LED's | 4-way Dubox housing (Berg 65240-004)** |
| PL11 | VGA CRT Interface | Standard 0.1" 16-way (2 row) IDC socket |
| PL12 | PC Speaker Header | 2-way Dubox housing (Berg 65240-002)** |
| PL13 | Parallel Port Interface | Standard 0.1" 26-way (2 row) IDC socket |
| PL14 | COM2 RS232 Serial Port | Standard 9-way D-type socket |
| PL15 | 64-way PC/104 Expansion | PC/104 64-way stack-through connector |
| PL16 | PS/2 Mouse | PS/2 plug |
| PL17 | ELAN-104NC Power Supply Connector | 6-way Mini-Combicon (IMO 21-155 0/6) |
| PL18 | 40-way PC/104 Expansion | PC/104 40way stack-through connector |
| PL19 | Reset Switch Header | 2-way Dubox housing (Berg 65240-002)** |

\* Requires 0.025" pitch ribbon cable.
\*\* The Dubox housing connectors require crimps, Berg part number 76347-403.

**PL1 - VGA LCD Flat Panel**
40-way boxed vertical header

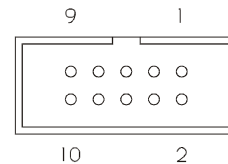| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | VDDSAFE | 2 | BKLSAFE |
| 3 | ENAVDD | 4 | ENAVEE |
| 5 | ENABKL | 6 | Ground |
| 7 | M | 8 | Ground |
| 9 | FLM | 10 | LP |
| 11 | Ground | 12 | SC |
| 13 | Ground | 14 | P0 |
| 15 | P1 | 16 | P2 |
| 17 | P3 | 18 | P4 |
| 19 | P5 | 20 | P6 |
| 21 | P7 | 22 | Ground |
| 23 | P8 | 24 | P9 |
| 25 | P10 | 26 | P11 |
| 27 | P12 | 28 | P13 |
| 29 | P14 | 30 | P15 |
| 31 | Ground | 32 | P16 |
| 33 | P17 | 34 | P18 |
| 35 | P19 | 36 | P20 |
| 37 | P21 | 38 | P22 |
| 39 | P23 | 40 | Ground |

| PL1 Signal Name | Description |
|---|---|
| ENAVDD | 65550 Flat Panel Display Interface Power sequencing control for panel driver electronics voltage VDD |
| ENAVEE | 65550 Flat Panel Display Interface Power sequencing control for panel LCD bias voltage VEE |
| VDDSAFE | 65550 Flat Panel Display Interface VDD Power, switched on-board Elan-104NC by ENAVDD |
| BKLSAFE | 65550 Flat Panel Display Backlight Power, switched on-board Elan-104NC by ENABKL |
| M | 65550 Flat Panel Display Interface M signal for AC drive control |
| ENABKL | 65550 Flat Panel Display Interface Enable Backlight |
| FLM | 65550 Flat Panel Display Interface First Line Marker |
| LP | 65550 Flat Panel Display Interface Latch Pulse |
| SC | 65550 Flat Panel Display Interface Shift Clock |
| P0-23 | 65550 Flat Panel Display Interface Flat panel data output |

### PL2 - General Purpose I/O
10-way 0.1" IDC header

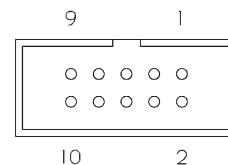| Pin | Signal Name | Pin | Signal Name |
|---|---|---|---|
| 1 | GND | 2 | +5V |
| 3 | GPIO0 | 4 | GPIO1 |
| 5 | GPIO2 | 6 | GPIO3 |
| 7 | GPIO4 | 8 | GPIO5 |
| 9 | GPIO6 | 10 | GPIO7 |

### PL3 - RS485/422 COM3
10-way 0.1" IDC header
The 10-way header PL3 provides the RS422/RS485 serial communications.

| Pin | Signal Name | Pin | Signal Name |
|---|---|---|---|
| 1 | **DO NOT CONNECT** | 2 | **DO NOT CONNECT** |
| 3 | FGND | 4 | FGND |
| 5 | RX/TX+ | 6 | RX/TX- |
| 7 | RS422 RX+ | 8 | RS422 RX- |
| 9 | FGND | 10 | NC |

### PL4 - PS/2 Keyboard
6-way mini-din socket

| Pin | Signal Name |
|---|---|
| 1 | KB DATA |
| 2 | No Connect |
| 3 | Ground |
| 4 | +5V |
| 5 | KB CLOCK |
| 6 | No Connect |
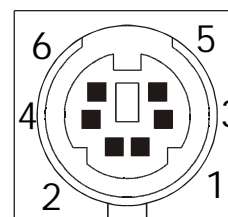
### PL5 - Ethernet RJ45
8-way RJ45

| Pin | Signal Name |
|-----|-------------|
| 1 | TX+ |
| 2 | TX- |
| 3 | RX+ |
| 4 | No Connect |
| 5 | No Connect |
| 6 | RX- |
| 7 | No Connect |
| 8 | No Connect |
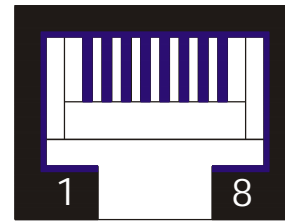
### PL6 - Suspend/Resume
2-way Dubox header
Pin 1 is pulled high by a 10K resistor.  A rising edge on pin 1 (a change of state from logic '0' to logic '1') causes the system to toggle mode from suspend to resume or from resume to suspend.  Momentarily shorting pins 1 and 2 of PL6 achieves this.

| Pin | Signal Name |
|-----|-------------|
| 1 | Suspend Input |
| 2 | Ground |
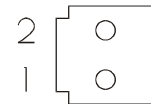
### PL7 - RS-232 COM1
9-way D-Type plug
Standard pin-out RS-232 serial communications are provided on COM1 and COM2.

## PL8 - IDE HDD Connector
40-way 0.1" IDC header

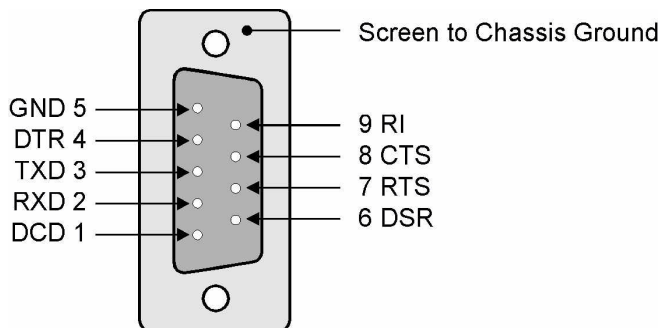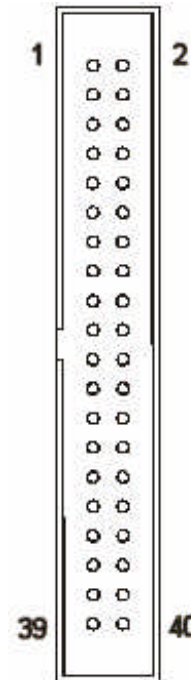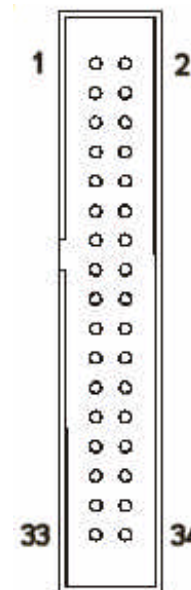| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1   | /RESET      | 2   | Ground      |
| 3   | D7          | 4   | D8          |
| 5   | D6          | 6   | D9          |
| 7   | D5          | 8   | D10         |
| 9   | D4          | 10  | D11         |
| 11  | D3          | 12  | D12         |
| 13  | D2          | 14  | D13         |
| 15  | D1          | 16  | D14         |
| 17  | D0          | 18  | D15         |
| 19  | Ground      | 20  | No Connect  |
| 21  | DREQ        | 22  | Ground      |
| 23  | /IOW        | 24  | Ground      |
| 25  | /IOR        | 26  | Ground      |
| 27  | /IOCHRDY    | 28  | Ground      |
| 29  | DACK        | 30  | Ground      |
| 31  | INTR        | 32  | /IOCS16     |
| 33  | A1          | 34  | No Connect  |
| 35  | A0          | 36  | A2          |
| 37  | /CS0        | 38  | /CS1        |
| 39  | LED         | 40  | Ground      |

## PL9 Floppy Disk Drive Connector
34-way 0.1" IDC header
A standard PC-type twisted floppy drive cable is needed when connecting a drive to the ELAN-104NC.

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1   | Ground      | 2   | DENSEL      |
| 3   | Ground      | 4   | No connect  |
| 5   | No connect  | 6   | DRATE       |
| 7   | Ground      | 8   | /INDEX      |
| 9   | Ground      | 10  | /MTR0       |
| 11  | Ground      | 12  | /DRV1       |
| 13  | Ground      | 14  | /DRV0       |
| 15  | Ground      | 16  | /MTR1       |
| 17  | Ground      | 18  | DIR         |
| 19  | Ground      | 20  | /STEP       |
| 21  | Ground      | 22  | /WDATA      |
| 23  | Ground      | 24  | /WGATE      |
| 25  | Ground      | 26  | /TRK0       |
| 27  | Ground      | 28  | /WP         |
| 29  | Ground      | 30  | /RDATA      |
| 31  | Ground      | 32  | HDSEL       |
| 33  | Ground      | 34  | DSKCHG      |

## PL10 - Ethernet Status LED's
4-way Dubox header

| Pin | Signal Name |
|-----|-------------|
| 1 | +5V |
| 2 | RX LED |
| 3 | Link LED |
| 4 | TX LED |
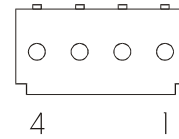
## PL11 - VGA CRT
16-way 0.1" IDC header

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | Red | 2 | Red GND |
| 3 | Green | 4 | n/c |
| 5 | Blue | 6 | Green GND |
| 7 | n/c | 8 | n/c |
| 9 | Blue GND | 10 | GND |
| 11 | Sync GND | 12 | HSYNC |
| 13 | n/c | 14 | VSYNC |
| 15 | n/c | 16 | n/c |
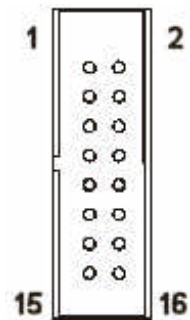
## PL12 - External Speaker
2-way Dubox header

| Pin | Signal Name |
|-----|-------------|
| 1 | +5V |
| 2 | SPKRDRV |
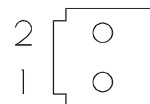
## PL13 - LPT Parallel Port
26-way 0.1" IDC header

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | /STROBE | 2 | /AUTO |
| 3 | D0 | 4 | /ERROR |
| 5 | D1 | 6 | /INIT |
| 7 | D2 | 8 | /SELECT |
| 9 | D3 | 10 | Ground |
| 11 | D4 | 12 | Ground |
| 13 | D5 | 14 | Ground |
| 15 | D6 | 16 | Ground |
| 17 | D7 | 18 | Ground |
| 19 | /ACK | 20 | Ground |
| 21 | BUSY | 22 | Ground |
| 23 | PAPER END | 24 | Ground |
| 25 | Printer Selected | 26 | No Connect |
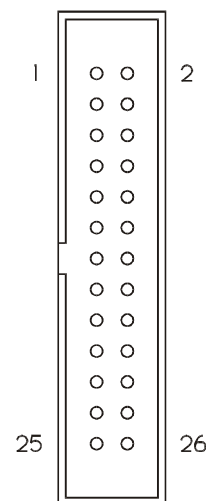
**PL14 - COM2 RS232**
9-way D-Type plug
Standard pin-out RS-232 serial communications are provided on COM1 and COM2.

```
                                    Screen to Chassis Ground
  GND 5 ───────                      9 RI
  DTR 4 ───────                      8 CTS
  TXD 3 ───────                      7 RTS
  RXD 2 ───────                      6 DSR
  DCD 1 ───────
```
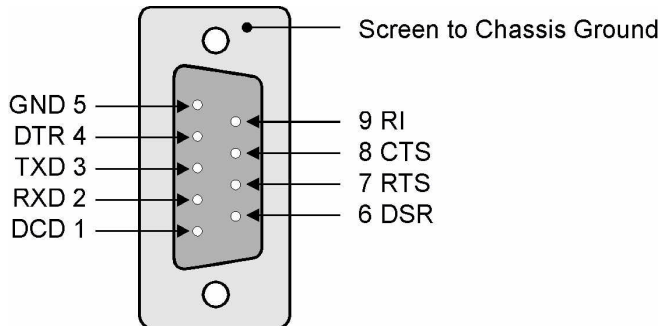
**PL15 & PL18 - PC/104 Interface**
Both 8-bit and 16-bit modules can be fitted to the ELAN-104NC. The board complies with the PC/104 specification with the exception that the MASTER* signal line is not implemented on the 40-way connector. The ELAN-104NC is therefore the only master allowed in the system.

Care should be taken when installing modules, especially 16-bit types.  Ensure that all the pins are correctly aligned with the sockets on the ELAN-104NC before pushing home. The module should then be secured with the fixing kit provided.

| Pin | Row A | Row B | Row C | Row D |
|-----|-------|-------|-------|-------|
| 0 | - | - | Ground | Ground |
| 1 | /IOCHCK | Ground | /SBHE | /MEMCS16 |
| 2 | D7 | RSTDRV | LA23 | /IOCS16 |
| 3 | D6 | +5V | LA22 | IRQ10 |
| 4 | D5 | IRQ9 | LA21 | IRQ11 |
| 5 | D4 | - | LA20 | IRQ12 |
| 6 | D3 | DRQ2 | LA19 | IRQ15 |
| 7 | D2 | -12V | LA18 | IRQ14 |
| 8 | D1 | /ENDXFR | LA17 | /DACK0 |
| 9 | D0 | +12V | /MEMR | DRQ0 |
| 10 | IOCHRDY | - | /MEMW | /DACK5 |
| 11 | AEN | /SMEMW | D8 | DRQ5 |
| 12 | A19 | /SMEMR | D9 | /DACK6 |
| 13 | A18 | /IOW | D10 | DRQ6 |
| 14 | A17 | /IOR | D11 | /DACK7 |
| 15 | A16 | /DACK3 | D12 | DRQ7 |
| 16 | A15 | DRQ3 | D13 | +5V |
| 17 | A14 | DACK1 | D14 | MASTER |
| 18 | A13 | DRQ1 | D15 | Ground |
| 19 | A12 | /REFRESH | - | Ground |
| 20 | A11 | SYSCLK | - | - |
| 21 | A10 | IRQ7 | - | - |
| 22 | A9 | IRQ6 | - | - |
| 23 | A8 | IRQ5 | - | - |
| 24 | A7 | IRQ4 | - | - |
| 25 | A6 | IRQ3 | - | - |
| 26 | A5 | /DACK2 | - | - |
| 27 | A4 | TC | - | - |
| 28 | A3 | BALE | - | - |
| 29 | A2 | +5V | - | - |
| 30 | A1 | OSC | - | - |
| 31 | A0 | Ground | - | - |
| 32 | Ground | Ground | - | - |
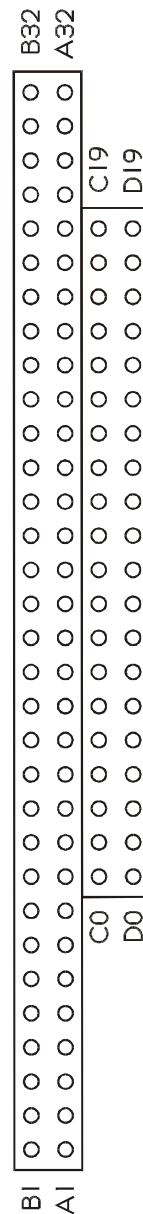
## PL16 - PS/2 Mouse
6-way mini-din socket

| Pin | Signal Name |
|-----|-------------|
| 1 | MS DATA |
| 2 | No Connect |
| 3 | Ground |
| 4 | +5V |
| 5 | MS CLOCK |
| 6 | No Connect |

**Arcom**
CONTROL SYSTEMS
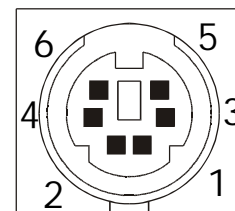
**PL17 - Power Connector**
6-way

| | |
|---|---|
| ■ | +VBAT |
| ■ | +5V |
| ■ | +12V |
| ■ | -12V |
| ■ | GND |
| ■ | GND |
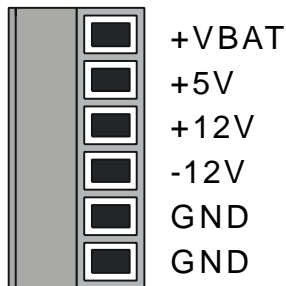
The board only requires +5V for normal operation.  If however any additional PC/104 modules are fitted +/-12V may also be required. There is no on-board +5V to +/-12V converter. If required, +/-12 should be connected to the plug-in terminal block of PL17 as shown. The board typically draws 1A from the +5V supply with no power saving features active.

An external battery back-up voltage +VBAT can be connected to the board also at PL17. The external voltage used should be greater than 2.8V and less than 3.3V. The average drain current is less than 10μA.
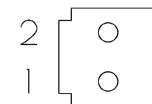
**PL18 - 16-Bit PC/104 Interface**
See PL15 table for details.

**PL19 - External Reset**
2-way Dubox header

| Pin | Signal Name |
|-----|-------------|
| 1 | Reset Input |
| 2 | Ground |

# Appendix B – Specifications

| | |
|---|---|
| **Microcontroller** | AMD ELAN SC400 Microcontroller |
| **Speed** | 100MHz, 66MHz, 33MHz, 16MHz and 8MHz options |
| **Memory** | 4 or 16 Mbytes DRAM<br>4 or 8 Mbytes Flash<br>128 Kbytes SRAM |
| **VGA Video** | Chips and Technology 65550 HiQVideo<br>High Performance Flat Panel / CRT VGA controller<br>1Mb Video DRAM |
| **Resolution** | 640   x  480  -  8/16/24 bpp<br>800   x  600  -  8/16/24 bpp<br>1024 x  768  -  8/16     bpp |
| **Keypad Matrix** | Maximum of 16 keys (4 x 4) using General Purpose I/O |
| **Peripherals** | Serial            - 16550 Compatible UARTS on COM1,2 and 3<br>                       RS232 – COM1 and COM2<br>                       RS422/485 – COM3<br><br>Parallel Port  - SPP/EPP/ECP<br>Keyboard       - PS/2 style<br>Mouse           - PS/2 style<br>Floppy           - 2 drives supported<br>IDE               - 2 drives supported |
| **Flash Erases** | 100,000 Cycles per block (minimum) |
| **On-Board Battery** | Lithium 170mAh capacity<br>Hold-up time = 17,000 hours nominal (continuous back-up)<br>Shelf life 5 years |
| **Real Time Clock** | Accuracy - $\pm$ 1 min/month |
| **Software** | Datalight ROM-DOS operating system<br>Datalight FlashFX flash filing system<br>Datalight BIOS |
| **Operating temperature range:** | -20°C to +70°C without on-board battery fitted (@66MHz)<br>-10°C to +65°C with battery fitted (@66MHz)<br>The board is rated to a maximum of +50°C when run at 100MHz.<br>The board uses commercial parts rated 0°C to +70°C. Tests have been carried and passed over a temperature range of -20°C to +70°C. |
| **Storage temperature range:** | -40°C to +125°C |
| **Power consumption:** | 1A @+5v typical max. (with no power management active)<br>240mA @+5v min (Processor and video in suspend) |
| **MTBF** | 83696 hours<br>(using generic figures from MIL-HDBK-217F at ground benign) |
| **Dimensions** | Standard Eurocard 100mm x 160mm (3.94" x 6.30") |
| **Weight** | 152g |

# Appendix C - Mechanical Layout (All dimensions in mm)
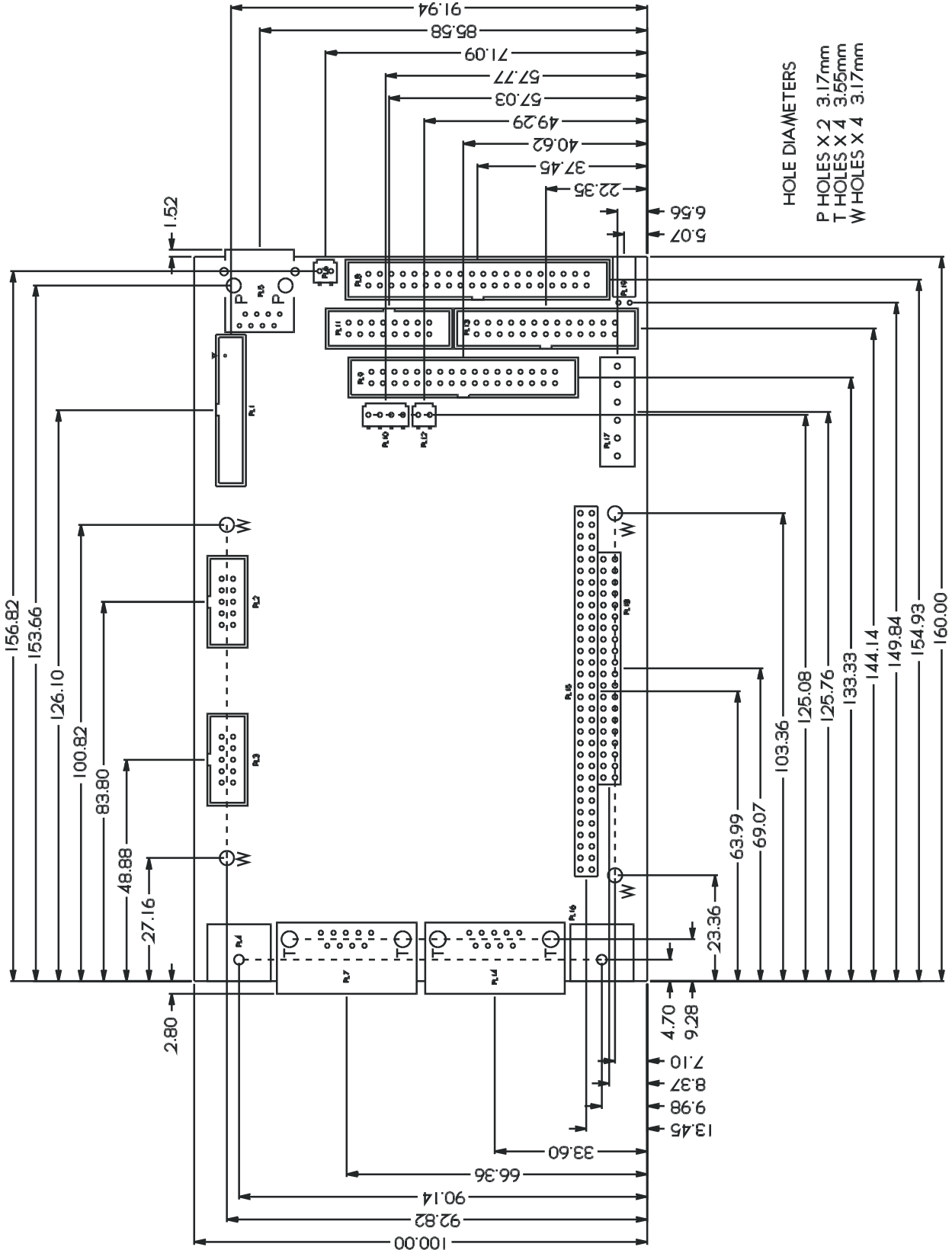
# Appendix D – Bibliography

**AMD ELAN SC400**     User Manual and Register Set

AMD
One AMD Place
P.O. Box 3453
Sunnyvale
California
http://www.amd.com

**Peripherals**          SUPER I/O SMCS FDC37C932

http://www.smsc.com

**VGA Controller**       Chips and Technologies 65550 High Performance Flat Panel / CRT VGA Controller

Asiliant Technologies
256 E. Gish Road –San Jose,
Ca 95112
http://www.asiliant.com

**Strata Flash**         Intel Strata Flash DA28F320, DA28F640
http://developer.intel.com/design/flash/isf/index.htm

**ROM-DOS**              Datalight Inc.
**FlashFX**              21520 30$^{th}$ Ave. SE
**BIOS**                 Suite 110
Bothell
WA 98021
http://www.datalight.com

**PC/104 Consortium**    PC/104 Specifications. Vendor information and available add on products.
http://www.pc104.org

**Ethernet**             RealTek RTL8019A 10BaseT Ethernet controller
http://www.realtek.com.tw

# Appendix E - Arcom FPIF

The Flat panel variant of the ELAN-104NC development kit contains a small interface board for the flat panel signals. The flat panel connector on the ELAN-104NC is a 40-way high-density IDC style connector. When attaching flat panels during development it is difficult to connect to the ribbon cable. Therefore the Flat Panel Interface Board (FPIF) was developed to route the signals to more conventional style connectors.

The FPIF board has five connectors:

PL1 is a 40-way IDC style high-density connector, which is pin-pin compatible with the flat panel connector on the ELAN104-NC and is designed to be connected via a 1:1 ribbon cable

PL2 is a 60-way 0.1' boxed header. This connector contains the panel data and control signals for the flat panel display. A suitable 'Crimp and poke' style connector can be obtained from various sources for this connector and this allows easy connection to different styles of flat panel display. A suitable cable is supplied in the development kit, which interfaces to the NEC 6.5" flat panel.

PL3 is a 6 way Dubox style connector that is designed to interface to the backlight inverter.

PL4 is a 2 way Dubox header that can be used to add a CONTRAST potentiometer for the backlight brightness.

## Links:

**LK1 - Shift Clock buffer enable**
Some flat panels require the shift clock to be buffered.

| LK1 | Description |
|-----|-------------|
| A | Shift Clock not buffered |
| B+ | Shift Clock buffered |

**LK2 - Shift Clock buffer polarity**
Some flat panels require the shift clock to be inverted.

| LK2 | Description |
|-----|-------------|
| A | Shift Clock buffered and inverted |
| B+ | Shift Clock buffer and non-inverted |

The following tables show the pin assignment for each connector.

**PL1 - ELAN104-NC Interface Connector**
40 way header

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | VDDSAFE | 2 | BLKSAFE |
| 3 | ENAVDD | 4 | ENAVEE |
| 5 | ENABLK | 6 | Ground |
| 7 | M | 8 | Ground |
| 9 | FLM | 10 | LP |
| 11 | Ground | 12 | SC |
| 13 | Ground | 14 | P0 |
| 15 | P1 | 16 | P2 |
| 17 | P3 | 18 | P4 |
| 19 | P5 | 20 | P6 |
| 21 | P7 | 22 | Ground |
| 23 | P8 | 24 | P9 |
| 25 | P10 | 26 | P11 |
| 27 | P12 | 28 | P13 |
| 29 | P14 | 30 | P15 |
| 31 | Ground | 32 | P16 |
| 33 | P17 | 34 | P18 |
| 35 | P19 | 36 | P20 |
| 37 | P21 | 38 | P22 |
| 39 | P23 | 40 | Ground |

## PL2 - Flat Panel Interface Connector
60 way 0.1" boxed header

| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1 | Ground | 2 | P0 |
| 3 | P1 | 4 | P2 |
| 5 | Ground | 6 | P3 |
| 7 | P4 | 8 | P5 |
| 9 | Ground | 10 | P6 |
| 11 | P7 | 12 | P8 |
| 13 | Ground | 14 | P9 |
| 15 | P10 | 16 | P11 |
| 17 | Ground | 18 | P12 |
| 19 | P13 | 20 | P14 |
| 21 | Ground | 22 | P15 |
| 23 | P16 | 24 | P17 |
| 25 | Ground | 26 | P18 |
| 27 | P19 | 28 | P20 |
| 29 | Ground | 30 | P21 |
| 31 | P22 | 32 | P23 |
| 33 | Ground | 34 | N/C |
| 35 | N/C | 36 | N/C |
| 37 | Ground | 38 | N/C |
| 39 | N/C | 40 | N/C |
| 41 | Ground | 42 | N/C |
| 43 | N/C | 44 | N/C |
| 45 | Ground | 46 | N/C |
| 47 | P34 | 48 | N/C |
| 49 | Ground | 50 | SHFCLK |
| 51 | Ground | 52 | LP |
| 53 | Ground | 54 | M |
| 55 | ENAVEE | 56 | FLM |
| 57 | Ground | 58 | Ground |
| 59 | Ground | 60 | VDDSAFE |

## PL3 - Backlight Inverter
6 way Dubox header

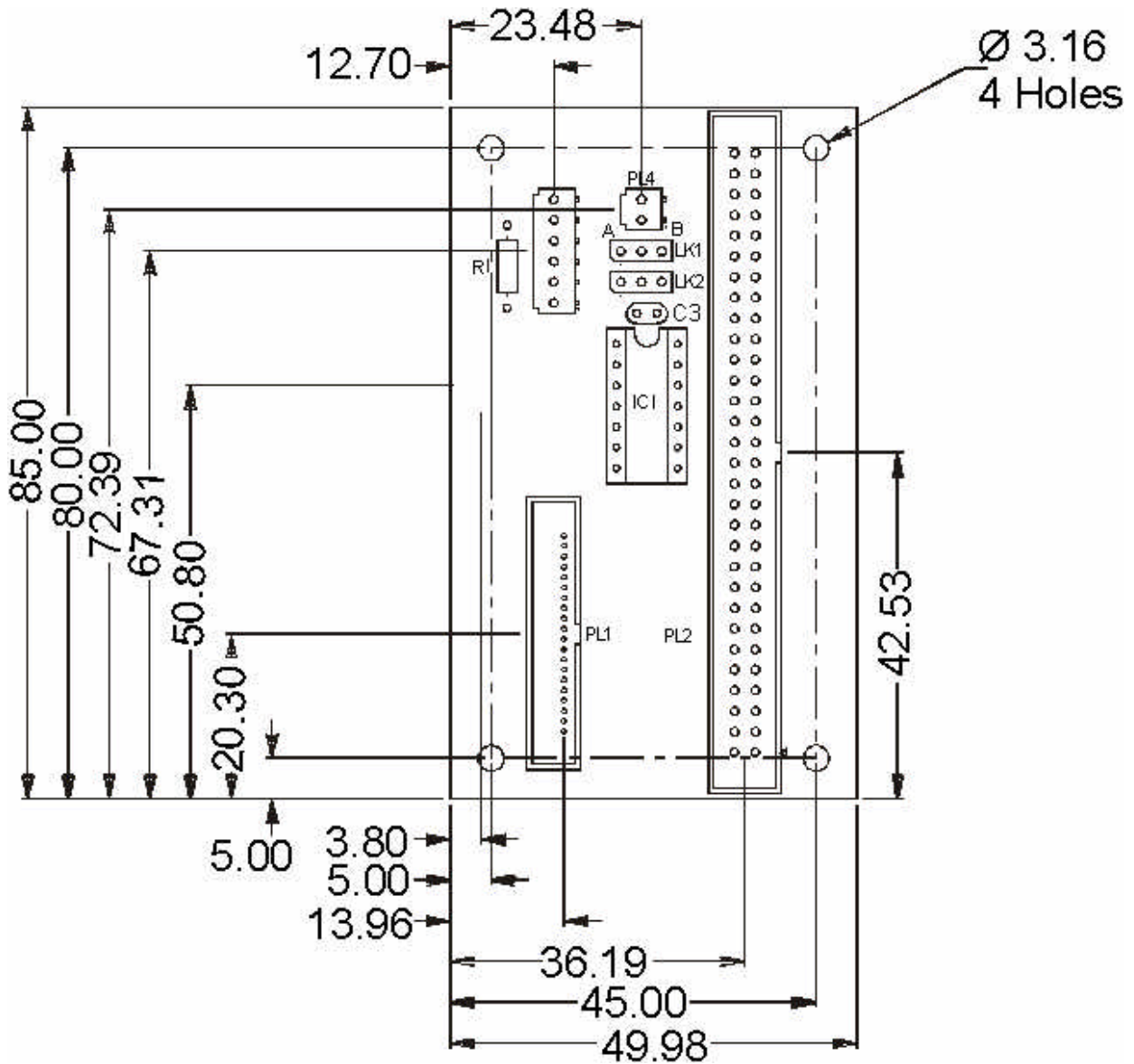| Pin | Signal Name |
|-----|-------------|
| 1 | Ground |
| 2 | Ground |
| 3 | BLKSAFE (depends upon LK11 on ELAN-104NC) |
| 4 | BLKSAFE (depends upon LK11 on ELAN-104NC) |
| 5 | Brightness Control Low |
| 6 | Brightness Control High |

## PL4- Contrast Potentiometer
2 way Dubox header

| Pin | Signal Name |
|-----|-------------|
| 1 | Brightness Control Low |
| 2 | Brightness Control High |

**PL3 - Backlight Inverter**

# FPIF Mechanical Diagram

# Connection Details for 6.5" NEC display (NL6448BC20-08)

The following table provides connection details for the 6.5" NEC flat panel that is supplied as part of the flat panel development kit. The table shows connections for the FPIF board and also for the ELAN-104NC directly.

| Signal Name | ELAN-104 NC PL1 | FPIF1 PL2 | DF9M-31 D-type |
|---|---|---|---|
| VDDSAFE | 1 | 60 | 28,29 |
| M | 7 | 54 | 27 |
| FLM | 9 | 56 | 4 |
| LP | 10 | 52 | 3 |
| SC (SHFCLK) | 12 | 50 | 2 |
| P3 | 17 | 6 | 21 |
| P2 | 16 | 4 | 20 |
| P5 | 19 | 8 | 23 |
| P4 | 18 | 7 | 22 |
| P7 | 21 | 11 | 25 |
| P6 | 20 | 10 | 24 |
| P10 | 25 | 15 | 13 |
| P11 | 26 | 16 | 14 |
| P13 | 28 | 19 | 16 |
| P12 | 27 | 18 | 15 |
| P15 | 30 | 22 | 18 |
| P14 | 29 | 20 | 17 |
| P19 | 35 | 27 | 7 |
| P18 | 34 | 26 | 6 |
| P21 | 37 | 30 | 9 |
| P20 | 36 | 28 | 8 |
| P23 | 39 | 32 | 11 |
| P22 | 38 | 31 | 10 |
| Ground | 6,8,11,13,22,31,4,0 | 1,5,25,49,5,9 | 1,5,12,19,26 |

# Appendix F – Environmental Considerations

The following table outlines the maximum ambient temperature (°C) at Various Airflow's, for the Elan SC400 device.

| | Airflow in Feet/Minute (m/s) | | | | |
|---|---|---|---|---|---|
| | 0 | 200 | 400 | 600 | 800 |
| Maximum T$_A$ | (0) | (1.01) | (2.03) | (3.04) | (4.06) |
| **at 33 MHz** | **83.7** | **86.4** | **87.3** | **87.8** | **88.3** |
| **at 66 MHz** | **72.0** | **77.5** | **79.3** | **80.4** | **81.3** |
| **at 100 MHz** | **50.8** | **59.0** | **61.7** | **63.4** | **64.6** |

It is possible to extend the temperature range of the SC400 device, by attaching a suitable heat sink. We recommend a heat sink with the following characteristics:

- Thermal Resistance at 85°C [°C/W] = 20
- Power dissipation at 85°C [W] = 3.1

Recommend part:
    Fischer Elektronik: **ICK BGA 27 x 27**

# Appendix G – Troubleshooting

The ELAN-104NC board is delivered 'Ready to Run' and will automatically start running and load an operating system. Either from flash memory (ROMDOS pre installed) or disk drive when power is applied. Once the board is running the information in this manual will provide you with guidelines and connection details for attaching peripherals and using the board.

If you are experiencing problems with a particular feature of the board, please refer to the relevant documentation to ensure that the board is configured correctly. If you are still experiencing problems then contact Arcom Control Systems Technical Support team who will be able to offer advice and investigate the problem.

If the board does not start running when power is applied, and the display remains blank, then there may be a problem with the system configuration. Follow these steps below to determine the cause of the problem.

1. Switch OFF the ELAN-104NC and disconnect from the power supply. Switch on the supply and measure the output voltage with a digital voltmeter (DVM). This should be between +4.75V and +5.25V. If this is incorrect adjust and re-apply the power to the board. If the board does not work go to step 2.

2. With the power supply connected and switched ON. Check the voltage at the power connector PL17 between +5v and GND. If this voltage is outside the tolerance in step 1, adjust the main supply until it meets the specification. The board should automatically start running when the supply reaches the minimum voltage, but switch OFF and ON again to make sure that the board starts correctly. If the board does not work go to step 3.

3. Remove any PC/104 adapter cards plugged into the ELAN-104NC. Apply power and check to see if the board starts up. If the board starts working check the link setting on the PC/104 board/s and adjust any settings that may conflict with the ELAN-104NC. Once the settings have been checked then plug each board in on its own to isolate any particular board, which is causing the problem. If the board does not work when the PC/104 boards are removed go to step 4.

4. Check all link setting are in the default location listed in the 'Links' section of the manual and remove all cables except the VGA Cable (or flat panel cable) and power supply cable. Apply power and check to see if the board starts up correctly. If you have completed the tasks outlined above and the board still fails to operate, then it will need to be returned to Arcom Control Systems for repair. Please contact the technical support department for details on returning the board.