

**HiCO486**

**PC/104 Industrial PCs**

**HiCO486-DOC  
Manual**

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**emtrion**



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Manual Revision no.	Changes	Date
1	First edition	05-12-98/Bue
2	Revised edition	07-10-98/Bue
3	Corrections	12-11-98/Bue
4	Setup changed	04-19-99/Bue
5	Description of J12 and J3 corrected	10-09-01/Bue
6	Emtrion edition	02-06-04/Ma

This document is published by:

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June 2004 – 006

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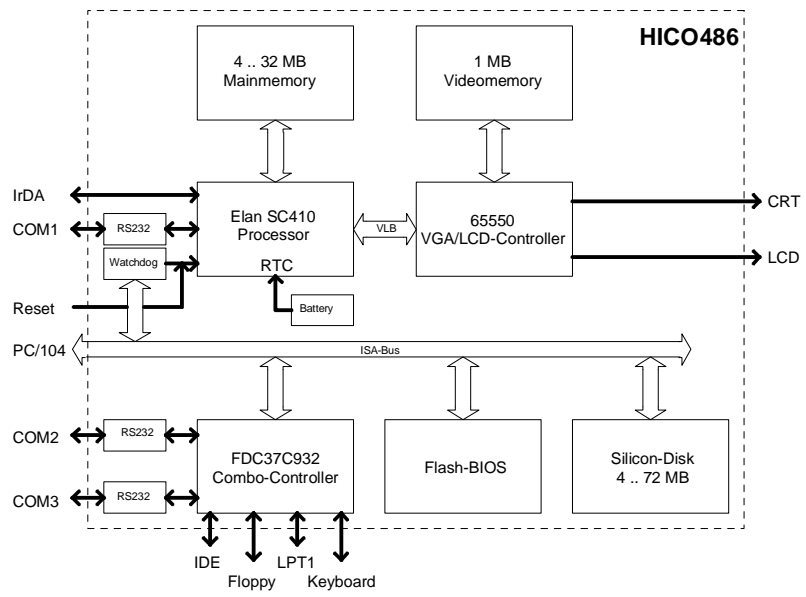
# 1. General Information

## 1.1. Introduction

HiCO486 is the ideal industrial PC for your control needs. Based on AMD's Élan SC410 processor this module is a complete PC and comes in the handy PC/104 format. The SC410 processor features the performance of a 486SX2 processor coupled with very low power consumption: at a clock rate of 66 MHz the module consumes less than 3 watts, which allows for operating temperatures up to 70°C without a heatsink [1]. The module may even be operated at 100 MHz, though with a restricted temperature range. HiCO486 features a main memory of up to 32 MB, a large Flash Disk and an LCD-VGA controller directly connected to the processor bus. In addition HiCO486 provides all the interfaces a developer would expect from an industrial PC.

This manual is addressed to Original Equipment Manufacturers (OEM) who wish to customize HiCO486 for their particular applications. It provides information and tips on both installation and configuration of the PC.

## 1.2. Block Diagram



### 1.3. Features of the HiCO486

Feature	Function	Options
Processor	ÉLAN™ SC410	
Clock frequency	66 MHz	99, 33 MHz
Cache	8 KB write back	
Main memory	4 MB	8, 16, 32 MB
BIOS	Award Elite BIOS	
Setup memory	128 bytes in the BIOS Flash	
CRT/LCD controller	C&T 65550 (VL-Bus Interface)	
Video RAM	1 MB	
Max. resolution	1280 x 1024 / 16 colors	
Max. color depth	16 M / 640 x 480 pixels	
Keyboard, PS/2 mouse	8042 compatible	
Serial ports	3 x RS232, 16550 compatible	
IrDa	Normal, Fast	
Parallel ports	1 x Standard, bidirectional, EPP, ECP	
Flash disk	-	4, 8, 24, 72 MB
Buffered SRAM	-	128 KB
Hard disk controller	2.5" EIDE	
Floppy disk controller	3.5" Floppy disk	
EEPROM	128 bytes, user-definable	
Watchdog	125 ms, can be set up to 2 s	
Interrupts on ISA bus	3, 6, 9, 14, selectable via jumpers from 5/7, 10/11, 12/15	
Shared interrupt	Can be set to 3 IRQs	
DMA channels on ISA bus	DRQ2, DRQ1 or DRQ5, settable	
Supply voltage	5 VDC, 600 mA at 66 MHz	
Backup battery	Lithium 170 mAh, on-board	Ext. battery
Operating temperature	-10°C to +70°C	
Storage temperature	-40°C to +125°C	
Dimensions	96 mm x 90 mm x 20 mm	



## 2. Installing HiCO486

Please read the following notes prior to installing the HiCO486 module. These hints apply to all ESD (electrostatic discharge) components:

- Before installing the module it is recommended that you discharge yourself by touching a grounded object.
- Be sure all tools required for installation are electrostatically discharged as well.
- Before installing (or removing) board, remove the power cable from your mains supply.
- Handle the board with care and try to avoid touching its components or tracks.

HiCO486 is a CPU PC/104 module and may be operated both within a PC/104 system and standalone. When installing the board, care must be taken of the following:

- Make sure all jumpers are properly set.
- Any previously installed CPU modules must be removed from your system. This also applies to components integrated on the HiCO486 module which are not switchable, such as the floppy disk controller and hard disk controller.
- Connect HiCO486 to the other components via the 104-contact J1 connector. Four fastening screws are provided to fix the board.
- Connect all required peripheral components (floppy drive, hard disk, keyboard, monitor, mouse and power supply etc.).
- If HiCO486 is operated standalone, voltage (+5 volts) can be supplied via the J3 connector or the PC/104 connector J1. The voltages +/-12 V are not required.
- HiCO486 is shipped in a conductive packaging. The soldered battery is protected with scotch tape against discharge during shipping; this tape can now be removed.



## 3. System Description

### 3.1. Memory Allocation

A HiCO486 module provides 4 MB up to 32 MB of main memory. The main memory is overlaid with ISA bus address space in the address range 0A0000h through 0FFFFFFh.

The memory allocation is as follows:

Address	Size	Used by
0000000 ... 009FFFFh	640 KB	Main memory
00A0000 ... 00BFFFFh	128 KB	Display store, segmented
00C0000 ... 00CFFFFh	64 KB	VESA bus, Video BIOS
00D0000 ... 00D1FFFh	8 KB	Silicon disk
00D2000 ... 00EFFFFh	120 KB	Free for extensions on the PC/104 bus or EMS
00F0000 ... 00FFFFFFh	64 KB	System BIOS
0100000 ... 1FFFFFFFh	31 MB	Max. 32 MB main memory
3000000 ... 30FFFFFFh	1 MB	Display store, linear
3FF0000 ... 3FFFFFFFh	64 KB	System BIOS

The free memory region D2000 through EFFFF can be overlaid with Expanded memory or is available as a memory region on the PC/104. When using expanded memory be sure the used memory regions are not overlaid with expanded memory.

In order to be able to execute BIOS routines faster, both the system BIOS and video BIOS are overlaid with Shadow RAM. This is automatically done by the BIOS.

### 3.2. I/O Addresses

The following is a list of all I/O addresses used by HiCO486's components. These addresses may not be used by expansion modules on the PC/104 bus.

Address	Usage
000 ... 01Fh	DMA Controller 1
020 ... 021h	Interrupt Controller 1
022 ... 023h	Processor Setup
040 ... 04Fh	Timer 1
060h, 064h	Keyboard Controller
061h	Port B
070 ... 071h	Real Time Clock
080	Status port
081 ... 08Fh	DMA page register
092h	Port A
0A0 ... 0A1h	Interrupt Controller 2
0C0 ... 0DFh	DMA Controller 2
0EA ... 0EBh	Combo Controller FDC37C932
1F0 ... 1F8h	IDE HD Controller
1FC ... 1FFh	Watchdog, Reset state
2F8 ... 2FFh	COM2
378 ... 37Fh	LPT1
3C0 ... 3DFh	VGA Controller
3E0 ... 3E1h	PC Card Register
3E8 ... 3EFh	COM3
3F0 ... 3F1h	Combo Controller FDC37C932
3F0 ... 3F7h	Floppy Disk Controller
3F8 ... 3FFh	COM1

### 3.3. Port A

Port A is accessed via I/O address 92h. Via this port the A20 line and the CPU reset can be accessed so that they are PS/2 compatible. Only bits 0 and 1 are used; the other bits always yield 0 with reads. These bits should also be written as 0.

Bit	Significance
7..2	not used, always 0
1	A20 Gate 0: address A20 remains 0 1: A20 under CPU control
0	Fast CPU reset 0: no reset activation 1: reset pulse to CPU

### 3.4. Port B

Port B is accessed via I/O address 61h. It provides the bits for accessing the loudspeaker. Bits 0 to 3 are both writable and readable, bits 4 to 7 are read-only.

In the HiCO486 the NMI logic was not implemented via Port B, as is usually the case with standard PCs. The standard sources for an NMI, RAM Parity Error and IOCHCK of the ISA bus are not available in the ÉLAN SC410.

Bit	Significance
7	Unused, always 0
6	Unused, always 0
5	0/1: output level of timer 2
4	0/1: refresh display, changes every 15 $\mu$ s
3	Unused
2	Unused
1	Enable loudspeaker 0: loudspeaker off 1: loudspeaker on
0	Gate for loudspeaker Timer 2 0: Timer disabled 1: Timer enabled

### 3.5. Timers

The HiCO486 module has 3 timers. The timers are implemented in the SC410 processor and have the same functionality as the 82C54 of a standard PC; they are accessed via the I/O address 40h to 43h.

The output of Timer 0 is connected to IRQ0. This timer cyclically activates an interrupt every 54.93 ms. The IRQ0 interrupt serves as time base for time and date.

Timer 1 is not connected.

Timer 2 selects the loudspeaker's output. Both gate and output of the timer can be controlled via Port B under I/O address 61h.

In contrast to an input clock of 1.19318 MHz with standard PCs, the 3 timers operate at 1.1892 MHz. However, the BIOS takes this into account while programming Timer 0, so there are no time differences.

When programming Timer 1 and Timer 2 the differing input clock must be taken into account via the corresponding divisor.

### 3.6. Reset State

The cause of the last reset can be detected with a read from I/O address 1FEh. The register has the following assignment:

Bit	Significance
7 ... 2	Unused, always 1
1, 0	0 0: Power On reset 0 1: - 0 1: Watchdog reset 1 1: Reset button

### 3.7. Watchdog

The watchdog serves to monitor the user program. After the watchdog has been started it has to be cyclically retriggered. The trigger time can be specified between 200 ms and 2 s. If the pause up to the following trigger is longer than the time specified, the watchdog is running and the PC reset. After a reset, the watchdog is disabled.

The watchdog is served via the I/O addresses 1FCh and 1FDh, which have the following significance:

- The watchdog is activated by writing value 1 once to address 1FCh.
- The watchdog is disabled by writing value 2 16 times to address 1FCh. Note that 16 accesses are always required to disable the watchdog.
- The watchdog is retriggered by outputting the time value on address 1FDh. The time value may be between 0 and 14, which results in the following runtime of the watchdog:

$$\text{runtime} = 60 \text{ ms} + \text{TIME VALUE} * 131 \text{ ms}$$

### 3.8. EEPROM

HiCO486 provides a 128-byte EEPROM which can be used according to your needs. The EEPROM is organized as a memory with 64 \* 16 bits and is connected to FDC37C932 [3].

### 3.9. Real-Time Clock, CMOS-RAM

The Élan SC410 processor comes with an AT-compatible real-time clock with a 128-byte CMOS-RAM. Both clock and CMOS-RAM are battery-buffered. The CMOS-RAM contains the setup data of the BIOS and is not available to the user.

### 3.10. Silicon-Disk, SRAM

All HiCO486s have a 32-pin socket for the accommodation of a DiskOnChip® 2000 flash disk. The Silicon-Disk is located from D0000h to D1FFFh in the ISA address range. In addition, 28 KB of the main memory are used, so that only 612 KB of main memory are available to DOS. Sizes from 2 MB up to 76 MB are available. The Flash-Disk is bootable; owing to the driver installed the BIOS treats the Flash-disk like a hard disk. If both a Silicon-Disk and a hard disk are used, the Silicon-Disk automatically appears as drive D:. More information on formatting and configuring the Silicon-Disk can be obtained from the relevant manual contained on the supplied disk or under [4].

---

**Important note**

If the silicon disk is operated in addition to a hard disk which is not partitioned nor formatted, the Silicon-Disk will be drive C:, because the hard disk is not treated as a drive by the BIOS unless it is partitioned and formatted.

---

In place of the Flash-Disk an SRAM (128K \* 8) may also be installed in the socket. The SRAM is battery-buffered so that the data are kept with a power failure. By default, the SRAM may address 8 KB only. However size and location can be altered by reprogramming ROMCS1 of the Élan SC410 processor.

To select the Flash-Disk or SRAM the jumpers W1, W2 and W3 must be set properly:

- SRAM            W1, W2, W3 position 1-2
- Flash-Disk    W1, W2, W3 position 2-3

### 3.11. Interface for Mouse and Keyboard

An AT keyboard and a PS/2 mouse can be connected to HiCO486's keyboard controller. The connection is via the 10-contact J4 connector. The PS/2 mouse uses interrupt IRQ12, which must be set via the W10 jumper and the corresponding entry in the BIOS setup.

The J4 connector also provides connections for an external battery, a beeper and a reset button. For the assignment of the connector, see section 8.

### 3.12. Parallel Port LPT1

The parallel interface of the HiCO486 is connected to the 26-contact connector J5. In addition to the standard mode, LPT1 supports bidirectional operation and several ECP-, EPP modes. Both address and operating mode can be configured with the BIOS setup. The default setting is LPT1 (378h, IRQ7), Normal.

### 3.13. Serial Ports 1 to 3

HiCO486 provides 3 serial interfaces with drivers in accordance with RS232. These are connected to the 10-contact connectors J6, J7 and J8.

The default setting of the I/O addresses is in accordance with the PC standard:

- Port 1 : 3F8h - 3FFh, COM1
- Port 2 : 2F8h - 2FFh, COM2
- Port 3: 3E8h - 3EFh, COM3

The allocation of the addresses of the interfaces can be modified in the BIOS setup.

Port 1 is contained in the Élan SC410 processor and can only be switched between COM1 and COM2. Port 2 and Port 3 are integrated in the combo controller FDC37C932. Via setup the two ports can be defined as COM1 to COM4. These ports may also be set to any address by programming the FDC37C932 directly.

All 3 ports provide FIFOs and are 16C550-compatible.

### 3.14. IrDA

Via the BIOS setup the HiCO486's serial port Port 1 can be set to Slow-IrDA or Fast-IrDA mode. The baud rate with Slow-IrDA is 115 KB, and 1.152 MBaud in Fast-IrDA mode.

Together with the supply voltage the receive and transmit signals are connected to the J10 connector. Here a fiber-optic infrared transmitter, such as the Hewlett Packard HDSL-1100 must be connected.

## 3.15. TTL Output

Writes to the I/O address 80h are saved to a register. The register's outputs are connected to the 10-pin connector J15. The connector may be used as an 8-bit TTL output. The driver performance (+/-15 mA) allows the direct connection of LEDs.

During the self test of HiCO486 following a reset, the POST codes of the BIOS are also output to J15.

## 3.16. Video Controller

### 3.16.1. Implementation

HiCO486 provides connections for both a VGA monitor and several flat screen types. The analog monitor can be connected to the 10-pin connector J11, the flat screen to the 50-contact header J12. Both monitor types may also be operated simultaneously.

The VGA interface is based on the 65550 chip from Chips & Technologies. The controller directly connects to the Élan SC410 processor and provides a display store of as much as 1 MB. This allows for resolutions of up to 1280 \* 1024 pixels and true color display with a 24-bit color depth.

65540 is fully compatible with the VGA standard. This applies to the assignment of the registers and the Video BIOS. In addition EGA and CGA are supported [2].

### 3.16.2. Supported Video Modes

Mode	VESA VBE	Color	Text	Resolution	Frequency
0,1	-	16	40 x 25	320 x 200	70 Hz
2,3	-	16	80 x 25	640 x 200	70 Hz
4,5	-	4	40 x 25	320 x 200	70 Hz
6	-	2	80 x 25	640 x 200	70 Hz
7	-	Mono	80 x 25	720 x 350	70 Hz
D	-	16	40 x 25	320 x 200	70 Hz
E	-	16	80 x 25	640 x 200	70 Hz
F	-	Mono	80 x 25	640 x 350	70 Hz
10	-	16	80 x 25	640 x 350	70 Hz
11	-	2	80 x 30	640 x 480	60 Hz
12	-	16	80 x 30	640 x 480	60 Hz
13	-	256	40 x 25	320 x 200	70 Hz
20	120h	16	80 x 30	640 x 480	85 Hz
22	122h	16	100 x 37	800 x 600	85 Hz
24	124h	16	128 x 48	1024 x 768	85 Hz
28	128h	16	160 x 64	1280 x 1024	43 Hz Interl.
30h, 70h	101h	256	80 x 30	640 x 480	85 Hz
31h, 71h	100h	256	80 x 25	640 x 480	70 Hz
32h, 72h	103h	256	100 x 37	800 x 600	85 Hz
34h, 74h	105h	256	128 x 48	1024 x 768	75 Hz
40	110h	32K	80 x 30	640 x 480	85 Hz
41	111h	64K	80 x 30	640 x 480	85 Hz
43	114h	64K	100 x 37	800 x 600	75 Hz
50	112h	16M	80 x 30	640 x 480	60 Hz
64	104h	16	128 x 48	1024 x 768	60 Hz
68	106h	16	160 x 64	1280 x 1024	43 Hz Interl.
6A	102h	16	100 x 37	800 x 600	75 Hz

### 3.16.3. Display Drivers

To achieve higher resolutions a disk containing video drivers is supplied:

Operating System	Name	Date
Windows 3.1	W31132.ZIP	6/97
Windows 95	W95245.ZIP	12/97
Windows NT4.x	NT4115.ZIP	2/98
VESA	contained in the BIOS	

Further drivers and current versions can be found on the internet at:

<http://developer.intel.com/design/graphics/mobilegraphics/products/65550/65550.htm>

### 3.17. Floppy Drive

Via a 26-contact flat flexible circuitry connector a 3.5" floppy drive can be connected. In the BIOS setup the floppy drive must be specified as drive A with a capacity of 1.44 MB. The connection of a second drive is not possible.

The connector is suitable for the TEAC FD-05HF floppy drive.

### 3.18. Hard Disk

A 2.5"-IDE hard disk can be directly connected to HiCO486 via a 44-contact flat cable. Data and supply voltage are applied via the cable.

The hard disk will be specified as drive C in the BIOS setup. This also applies if an installed Silicon-Disk is specified as the first drive.

The settings for the hard disk can be made via the BIOS setup.

### 3.19. Loudspeaker, Reset

A loudspeaker or a Piezo signal generator and a reset generator can be connected to the J4 connector.

The loudspeaker is to be connected to pins 1 and 2, where pin 1 is the positive connection. The loudspeaker is selected via port B of the PC. The output signal of timer 2 is applied to the connector via a 100-nF capacitor; there is no dc signal.

Pin 3 is the 0-active reset input of the HiCO486. The reset pulse must last at least 150 ns. A reset button will be connected to pins 3 and 2.

### 3.20. Supply Voltage

HiCO486 operates at +5 volts, +/-5%. This voltage can be applied via the PC/104 connector or supply voltage connector. A voltage monitor activates a reset on the HiCO486 if the supply voltage is below 4.65 volts.

The voltages +12 volts and -12 volts for additional modules can also be applied via these two connectors.

### 3.21. Battery

HiCO486 provides a Lithium battery with a capacity of 170 mAh. This is sufficient to buffer both real-time clock and CMOS-RAM for approx. 4 years if the module is switched off. If it is switched on, the battery is voltage-free and the buffer time is extended accordingly.

Via the connections J4, pin 8 or J3, pin 6 an external battery can be connected. Both connections are coupled, only one connection may be used at a time. Internal and external battery are decoupled via diodes which prevents them from interfering with each other.

The BIOS checks the battery during the self test. A battery failure is output when the battery voltage falls below 2.4 volts. The battery is properly buffered up to 2.0 volts.



## 4. ROM BIOS

### 4.1. BIOS Chip

The system BIOS and the Video BIOS can be found in a common 128-KB EEPROM, which is located in the range from E0000h through FFFFFh. The data are stored in a compressed form and are automatically expanded into the Shadow RAM at the start. After this, the range from E0000h through EFFFFh is available to ISA bus modules or Expanded memory.

The EEPROM may be reprogrammed during operation, which allows for easy BIOS updates.

### 4.2. Power-On Self Test

After a reset, the BIOS runs a hardware self test. In addition all components are initialized. This stage is called Power On Self Test (POST). For all tests a code is written to the I/O address 80h. The test can be monitored by displaying the values written to this address. The BIOS is halted when an error occurs. The cause of the error can be recognized by the value last output. It is more convenient to monitor the codes via HiCO486's J15 connector. A list of all codes can be found under [5].

After initialization of the VGA controller, the errors detected during the self test can also be displayed on the screen. If the VGA part produces an error disabling screen outputs a sound signal (long-short-short) is output. After this, the BIOS continues to run.

The errors detected might be due to a defect or a wrong configuration; e.g. a floppy drive is specified but not connected. Wrong configurations can be modified via the setup.

### 4.3. Using Setup

The Award BIOS provides a setup via which HiCO486 can be configured. The setup settings are buffered both in the CMOS-RAM of the real-time clock and in the BIOS EEPROM. Saving the data in the EEPROM ensures that only date and time are lost if the battery is defective or flat. However, information about HiCO486's configuration will not get lost.

To go to the setup menu hit the **<DEL>** key during the self test of the hardware and before booting up the operating system. This message

**Press DEL to enter SETUP**

at the lower window border tells you when to do so. After this, a setup menu is available where you can select the desired items. Notes on how to navigate through the corresponding menus are given on the lower window border.

Leaving the configuration menu by hitting the **<ESC>** button does not alter the settings, **<F10>** saves the modifications to the CMOS-RAM and EEPROM. The setup uses an American keyboard layout. If you are using a German keyboard, a **<Z>** must be entered in place of a **<Y>**.

The following will give an overview of the individual setup pages and their default settings. You may modify the yellow entries only.

## 4.4. Setup Pages

### 4.4.1. STANDARD CMOS SETUP

		CYL	HEAD	PRE	LAND	SECT	MODE
Drive C:	Auto ( 0b)	0	0	0	0	0	AUTO
Drive D:	None ( 0b)	0	0	0	0	0	-----
Drive A:	1.44M, 3.5 in.						
Video:	EGA/VGA	Base Memory:		640K			
Halt On:	All, But Disk/Key	Extended Memory:		3072K			
		Other Memory:		384K			
		Total Memory:		4096K			

Apart from the date and time, the following entries may be modified:

#### Drive A:

None                      no floppy drive  
 1.44M, 3.5 in.          entry for drive TEAC FD05HF

#### Drive C:, Drive D:

None                      no hard disk  
 1 .. 45                  select one of 45 hard disk types  
 User                      parameters for hard disk specified by the user  
 Auto                      parameters are set through the BIOS at each reset

#### Halt On:

All Errors                halt bootstrap loading process on any error  
 No Errors                never halt bootstrap loading process  
 All, But Keyboard      ignore keyboard error  
 All, But Diskette      ignore floppy disk error  
 All, But Disk/Key      ignore floppy disk and keyboard error

#### 4.4.2. BIOS FEATURES SETUP

CPU Internal Cache	Enabled
Quick Power On Self Test	Enabled
Boot Sequence	A, C, SCSI
Boot Up Floppy Seek	Enabled
Boot Up NumLock Status	On
Boot Up System Speed	High
Gate A20 Option	Fast
Typematic Rate Setting	Disabled
Typematic Rate (Chars/Sec)	6
Typematic Delay (Msec)	250
Security Option	Setup
PS/2 mouse function control	Enabled

### 4.4.3. CHIPSET FEATURES SETUP

Auto Configuration	Enabled
CAS Precharge Delay	1 Clock
RAS to CAS Delay	3 Clock
Write Setup Time	1 Clock
CAS Pulse Width	3FP/2EDO
DRAM Interleave CTRL	0-1 I, 2-3 I
Hyper Speed Mode	Enabled
CPU Speed in Hyper Mode	66 MHz
CPU Speed in High Mode	33.18 MHz
CPU Speed in Low Mode	8.29 MHz

**Auto Configuration:**

The DRAM timing is set automatically (recommended)

#### 4.4.4. PNP CONFIGURATION

Resources Controlled By	Manual
Reset Configuration Data	Disabled
IRQ-3 assigned to	Legacy ISA
IRQ-4 assigned to	Legacy ISA
IRQ-5 assigned to	ISA PnP
IRQ-7 assigned to	Legacy ISA
IRQ-9 assigned to	ISA PnP
IRQ-10 assigned to	ISA PnP
IRQ-11 assigned to	Legacy ISA
IRQ-12 assigned to	ISA PnP
IRQ-14 assigned to	ISA PnP
IRQ-15 assigned to	Legacy ISA
DMA-1 assigned to	ISA PnP
DMA-5 assigned to	Legacy ISA

Interrupts specified for **Legacy ISA** cannot be used for Plug and Play configurations. The entries for IRQ5, IRQ7, IRQ10, IRQ11, IRQ12, IRQ15, DMA1 and DMA5 are automatically set in accordance with the jumper settings on page INTEGRATED PERIPHERALS. The corresponding unavailable input will be set to Legacy ISA, which prevents a non-existing resource from being allocated to a Plug and Play device.

#### 4.4.5. LOAD BIOS DEFAULTS

The default BIOS values are loaded. Operation is safe but slow.

#### 4.4.6. LOAD SETUP DEFAULTS

The emtrion setup values are loaded. Operation is very fast.

#### 4.4.7. INTEGRATED PERIPHERALS

IDE HDD Block Mode	Enabled
Onboard IDE1 Controller	Primary
Onboard FDC Controller	Enabled
Onboard Serial Port 1	3F8/IRQ4
Serial Port 1 Mode	Standard
Onboard Serial Port 2	2F8/IRQ3
Onboard Serial Port 3	3E8/IRQ9
Onboard Parallel Port	378/IRQ7
Parallel Port Mode	EPP1.7+SPP
PIRQ2 Jumper	IRQ 12
PIRQ5 Jumper	IRQ 10
PIRQ6 Jumper	IRQ 5
PDRQ1 Jumper	DRQ 1

**Serial Port 1 Mode:**

Standard	Serial Port 1 is COM1
Slow IrDA	Serial Port 1 is Slow IrDA Interface
Fast IrDA	Serial Port 1 is Fast IrDA Interface

By default, serial port 1 is operated as COM1 port. In addition the Irda interface may be used. The transceiver connection is via J10. In this case, the connection for COM1, J6, is not used.

**Parallel Port Mode:**

Normal	Unidirectional printer port
EPP1.7+SPP	EPP mode 1.7 and PS/2-compatible bidirectional mode
ECP+EPP1.7	ECP mode, EPP mode 1.7
SPP	PS/2-compatible bidirectional mode
EPP1.9+SPP	EPP mode 1.9 and PS/2-compatible bidirectional mode
ECP	ECP mode
ECP+EPP1.9	ECP mode, EPP mode 1.9

In the ECP mode and EPP modes this port may also be used as a normal printer port. No DMAs are used in the ECP mode.

The entries for **PIRQ2**, **PIRQ5**, **PIRQ6** and **PDRQ1** must correspond to the settings of the jumpers W6, W8, W10, W4 and W5.

#### **4.4.8. SUPERVISOR PASSWORD, USER PASSWORD**

Specifies a password. Once a password has been specified, the setup or bootstrap loading process is available only when the correct password has been entered. The parameters (SETUP or SYSTEM) for the password are specified on page BIOS FEATURE SETUP: SYSTEM means that a password must be entered for both booting and access to setup.

If both Supervisor- and User password are enabled, you are able to boot or enter setup using the Supervisor password. The User password allows you to boot, however, only the User password may be entered in the setup, all other pages are disabled.

#### **4.4.9. IDE HDD AUTO DETECTION**

The BIOS determines the parameters of the hard disk installed and specifies them as the default values for page STANDARD CMOS SETUP.

#### **4.4.10. SAVE & EXIT SETUP**

The parameters entered are saved and setup is left. Since the American keyboard layout is used in the setup, a 'Z' must be pressed for 'Y'. Hit <ESC> to exit setup.

#### **4.4.11. EXIT WITHOUT SAVING**

The parameters entered are not saved and setup is left. Since the American keyboard layout is used in the setup, a 'Z' must be pressed for 'Y'. Hit <ESC> to exit setup.



## 5. Special Features of the ISA Bus Interface

### 5.1. General Information

HiCO486's ISA bus connector is a 104-contact connector in accordance with PC/104 specification v2.3. This specification is based on the ISA bus standard IEEE P996.1 set by the PC/104 consortium [6].

Due to HiCO486's configuration the following are not in accordance with the PC/104 specification:

- The output signals are driven higher (+/-24mA) than is in accordance with the PC/104 specification. The input signals have a maximum low level of  $V_{iL} \max = 0.85$  volts, the minimum high level is  $V_{iH} \min = 2.15$  volts.
- Three interrupt lines support shared interrupts.
- All address lines A0 to A23 and SBHE\* are simultaneously enabled with BALE and remain stable over the whole access period. That is, no distinction is made between LA signals and SA signals.
- There are no refresh cycles on the ISA bus.
- The signals IOCHCK\*, ENDXFR\*, REFRESH\*, MASTER\*, IRQ4 and the DMA channels DMA0, DMA3, DMA6, DMA7 are not available.
- There are 6 interrupts: IRQ5, IRQ7, IRQ10, IRQ11, IRQ12 and IRQ15 of which three can be simultaneously used.
- Only the DMA channels 1, 2 and 5 are available. DMA2 is specified for the floppy disk controller.
- The 5-V supply voltage is not available.

The following will describe the selection of the interrupts and the free DMA channel in greater detail.

## 5.2. Interrupt Setting

The Élan SC400 processor provides eight inputs for external interrupts; the internal peripherals of the processor are directly connected to the interrupt controller.

In order to be able to use all interrupt lines of the ISA bus, 5 interrupt inputs are reserved for the HiCO486, the remaining three interrupt inputs are switchable. The following lists the assignment of the interrupts:

Interrupt	Function	Available on the PC/104 Bus
IRQ0	Timer 0	no
IRQ1	Keyboard	yes
IRQ2	Cascading	no
IRQ3	COM2	yes
IRQ4	COM1	no
IRQ5	LPT2	yes, switchable with IRQ7
IRQ6	Floppy Controller	yes
IRQ7	LPT1	yes, switchable with RQ5
IRQ8	RTC	no
IRQ9	-	yes
IRQ10	-	yes, switchable with IRQ11
IRQ11	-	yes, switchable with IRQ10
IRQ12	-	yes, switchable with IRQ15
IRQ14	IDE Controller	yes
IRQ15	-	yes, switchable with IRQ12

The selection of the interrupts IRQ5, IRQ7, IRQ10, IRQ11, IRQ12 and IRQ15 is through the jumpers W6, W8 and W10. See section "Jumpers" on p. 45 for more information on their locations and settings.

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These jumper settings must also be made in the BIOS setup on page INTEGRATED PERIPHERALS.

### 5.3. Handling Shared Interrupts

HiCO486 supports the handling of shared interrupts in accordance with the PC/104 specification v2.3. This means that a pullup- or pulldown resistor can be connected to 3 interrupt lines via the jumpers W7, W9 and W11. This function has been implemented for the 3 optional interrupts.

Jumper	Position	Function
W7	1-2	IRQ 5/7 normal
	2-3	IRQ 5/7 shared
W9	1-2	IRQ 10/11 normal
	2-3	IRQ 10/11 shared
W11	1-2	IRQ 12/15 normal
	2-3	IRQ 12/15 shared

In the **'normal'** position a 2.2-K $\Omega$  pullup resistor is connected to the line. This is in accordance with the standard specification of the ISA bus. In this case, only one user may actively drive an interrupt line.

In the **'shared'** position a 2.2-K $\Omega$  pulldown resistor is connected to the line. This allows you to operate several modules, which have implemented the shared interrupt function according to the PC/104 specification, on the same interrupt line.

The interrupt inputs of a PC are edge triggered. With shared interrupts it is difficult to determine whether several interrupts are simultaneously active on the same line. HiCO486 takes this into account and provides an additional logic. A positive signal edge is triggered on all lines where an interrupt is pending by writing to I/O address 1FDh. If this access occurs at the end of an interrupt service routine and if another interrupt is pending with another module, then this routine is automatically called again after termination.

## 5.4. DMA Settings

The Élan SC400 processor provides two external DMA channels of the ISA bus; the internal IrDA interface is directly connected.

With HiCO486 a DMA channel is on DRQ2. This DMA channel is used by the floppy controller. The second DMA channel is available for user extensions. You are able to switch between DRQ1 and DRQ5 via two jumpers and the corresponding setting in the BIOS setup.

DRQ1 is an 8-bit DMA channel, which is usually used by sound cards, etc. DRQ5 is a 16-bit DMA channel which is used by network cards.

For channel switching the following applies:

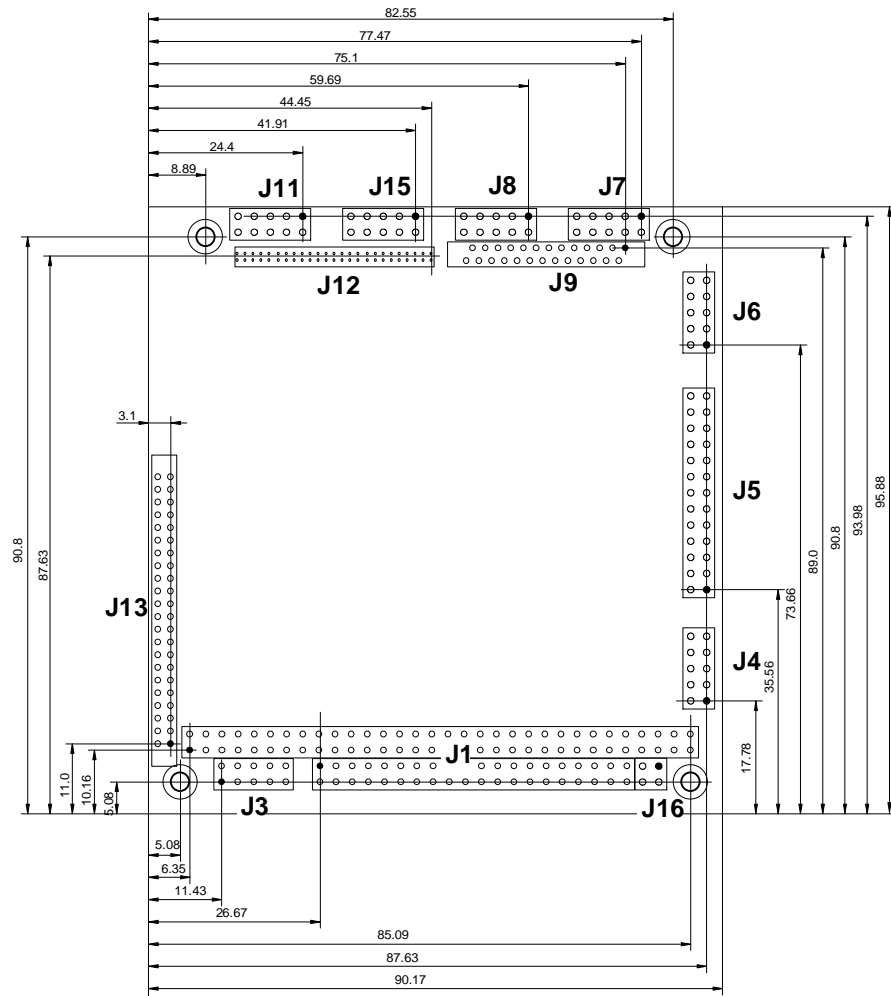
Jumper	Position	Function
W4	1-2 2-3	DRQ1 DRQ5
W5	1-2 2-3	DACK1 DACK5

The position of the jumpers W4 and W5 must not be altered!

The jumper settings and DMA channel set must also be made in the BIOS setup on page INTEGRATED PERIPHERALS.



## 6. Dimensional Drawing





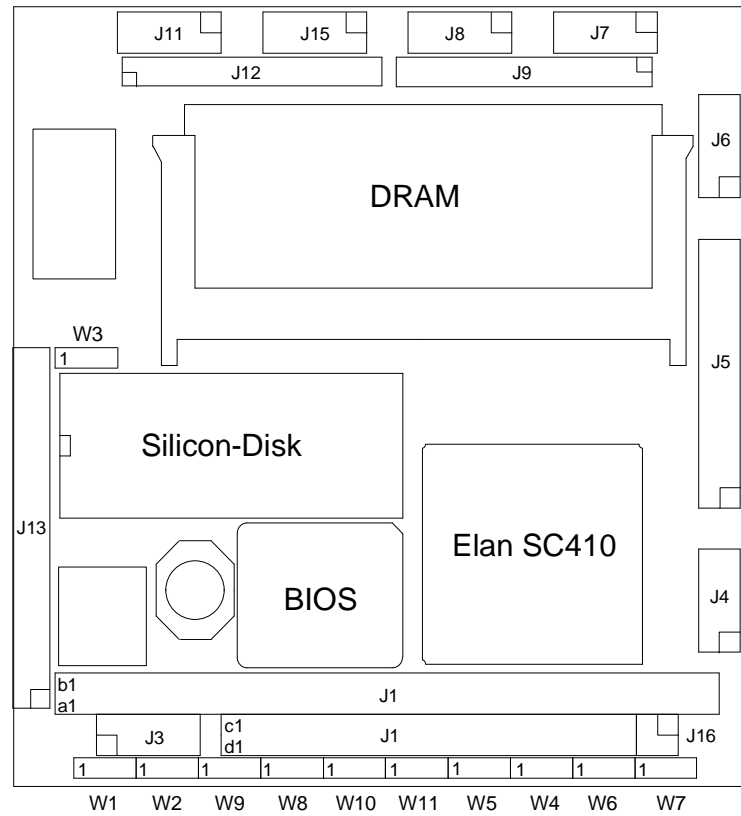
## 7. Jumpers

### 7.1. Jumper Setting

HiCO486 provides as much as 11 jumpers. The jumpers W1 to W3 serve to choose between the SRAM and Flash-Disk, the remaining jumpers are used to configure the interrupt- and DMA inputs.

Jumper	Position	Function
W1	1-2	SRAM, A15
	2-3	-
W2	1-2	SRAM, Write
	2-3	Flash-Disk, Write
W3	1-2	SRAM, battery-buffered
	2-3	Flash-Disk, not battery-buffered
W4	1-2	DMA channel 1
	2-3	DMA channel 5
W5	1-2	DMA channel 1
	2-3	DMA channel 5
W6	1-2	IRQ 5
	2-3	IRQ 7
W7	1-2	IRQ 5/7 normal
	2-3	IRQ 5/7 shared
W8	1-2	IRQ 10
	2-3	IRQ 11
W9	1-2	IRQ 10/11 normal
	2-3	IRQ 10/11 shared
W10	1-2	IRQ 12
	2-3	IRQ 15
W11	1-2	IRQ 12/15 normal
	2-3	IRQ 12/15 shared

## 7.2. Position of the Jumpers and Connectors





## 8. Pin Assignment

### 8.1. PC/104, J1

Type 64-pin + 40-pin connector with long pins, 2.54 mm

	Row A	Row B	Row C	Row D	
1	-	GND			
2	D7	RESET			
3	D6	+5 V			
4	D5	IRQ9			
5	D4	-			
6	D3	DRQ2			
7	D2	-12 V			
8	D1	-			
9	D0	+12 V	GND	GND	0
10	IOCHRDY	GND	SBHE#	MEMCS16#	1
11	AEN	SMEMW#	A23	IOCS16#	2
12	A19	SMEMR#	A22	IRQ10	3
13	A18	IOW#	A21	IRQ11	4
14	A17	IOR#	A20	IRQ12	5
15	A16	-	A19	IRQ15	6
16	A15	-	A18	IRQ14	7
17	A14	DACK1#	A17	-	8
18	A13	DRQ1	MEMR#	-	9
19	A12	REF#	MEMW#	DACK5#	10
20	A11	SYCLK	D8	DRQ5	11
21	A10	IRQ7	D9	-	12
22	A9	IRQ6	D10	-	13
23	A8	IRQ5	D11	-	14
24	A7	-	D12	-	15
25	A6	IRQ3	D13	+5 V	16
26	A5	DACK2#	D14	-	17
27	A4	TC	D15	GND	18
28	A3	BALE	-	GND	19
29	A2	+5 V			
30	A1	OSC			
31	A0	GND			
32	GND	GND			

## 8.2. Supply Voltage, J3

Type 10-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	GND	2	+5 V
3	GND	4	+5 V
5	GND	6	Batt
7	-	8	-
9	+12 V	10	-12 V

## 8.3. Keyboard, PS/2 mouse, J4

Type 10-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	Speaker	2	GND
3	Reset In	4	+5 V
5	KBD Data	6	KBD Clock
7	GND	8	Batt
9	Mouse Clock	10	Mouse Data

## 8.4. Parallel Interface, J5

Type 26-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	Strobe	2	AUTO FEED XT
3	Data Bit 0	4	ERROR
5	Data Bit 1	6	INIT
7	Data Bit 2	8	SLCT IN
9	Data Bit 3	10	GND
11	Data Bit 4	12	GND
13	Data Bit 5	14	GND
15	Data Bit 6	16	GND
17	Data Bit 7	18	GND
19	ACK	20	GND
21	BUSY	22	GND
23	PE	24	GND
25	SLCT	26	+5 V

## 8.5. Serial Interface, J6, J7, J8

Type 10-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	DCD	2	DSR
3	RxD	4	RTS
5	TxD	6	CTS
7	DTR	8	RI
9	GND	10	+5V

## 8.6. Floppy Disk Drive, J9

Type 26-pin FFC connector, 1 mm

Pin	Signal	Pin	Signal
1	+5 V	2	Index
3	+5 V	4	Drive Select 1
5	+5 V	6	Diskette change
7	-	8	-
9	-	10	Motor on 1
11	-	12	Direction Select
13	-	14	Step
15	GND	16	Write Data
17	GND	18	Write Gate
19	GND	20	Track 00
21	GND	22	Write protect
23	GND	24	Read data
25	GND	26	Head Select

## 8.7. VGA Monitor, J11

Type 10-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	GND	2	Red
3	GND	4	Green
5	GND	6	Blue
7	GND	8	HSYNC
9	VSYNC	10	GND

## 8.8. Flat Screen, J12

Type 50-pin connector, 1.27 mm

Pin	Signal	Pin	Signal
1	EVDD	2	+5 V
3	EVEE	4	+5 V
5	EBKL	6	+12V
7	M	8	+3.3V
9	GND	10	LP
11	FLM	12	GND
13	SCLK	14	GND
15	P0	16	P1
17	GND	18	P2
19	P3	20	GND
21	P4	22	P5
23	GND	24	P6
25	P7	26	GND
27	P8	28	P9
29	GND	30	P10
31	P11	32	GND
33	P12	34	P13
35	GND	36	P14
37	P15	38	GND
39	P16	40	P17
41	GND	42	P18
43	P19	44	GND
45	P20	46	P21
47	GND	48	P22
49	P23	50	GND



## 8.10. IDE Interface, J13

Type 44-pin connector, 2 mm

Pin	Signal	Pin	Signal
1	RESET	2	GND
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	GND	20	(TDO)
21	(TDI)	22	GND
23	IOW	24	GND
25	IOR	26	GND
27	IOCHRDY	28	BALE
29	(TMS)	30	GND
31	IRQ14	32	IOCS16
33	A1	34	-
35	A0	36	A2
37	CS0	38	CS1
39	SELECT	40	GND
41	+5 V	42	+5 V
43	GND	44	(TCK)

### Note

The connections for a JTAG interface are connected to pins 20, 21, 29 and 44. This interface is required for manufacturing and is of no significance for the user.

## 8.11. TTL Output, J15

Type 10-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	GN D	2	+5 V
3	D1	4	D0
5	D3	6	D2
7	D5	8	D4
9	D7	10	D6

## 8.12. IrDA, J16

Type 4-pin connector, 2.54 mm

Pin	Signal	Pin	Signal
1	SIRI	2	+5 V
3	SIRO	4	GND



## 9. Technical Data

### 9.1. Mechanical Data

<b>Weight</b>	100 g
<b>PCB</b>	Glasepoxi FR-4, UL listed, 10 layers
<b>Dimensions</b>	96 mm x 90 mm x 22 mm

### 9.2. Electrical Data

#### 9.2.1. Supply Voltage

<b>Supply voltage</b>	5 V, +/-5%
<b>Power consumption</b>	0.6 A at 66 MHz

#### 9.2.2. Electromagnetic Compatibility (EMC)

Carries the CE mark in accordance with EN50081-1, EN50082-2

<b>Noise emission EN55011</b>	Class B
<b>Electrostatic discharge IEC801-2</b>	8 kV air discharge, 4 kV contact discharge
<b>Electromagnetic radiation emission IEC801-3</b>	80 ... 1000 MHz, 10 V/m
<b>Inductive switch (burst) IEC801-4</b>	1 kV

### 9.3. Environmental Conditions

<b>Temperature</b>	-10 ... +70°C operation -40 ... +85°C storage
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<b>Rel. humidity</b>	0 ... 95 %, non-condensing
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## 10. Bibliographic Reference

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## 11. Connection Cable

To connect the peripheral devices monitor, keyboard, mouse, printer, hard disk and floppy drive to HiCO486, a specific cable set can be ordered under "HiCO486-CAB".

If you intend to build your own cables, please see the assignment below for keyboard and monitor. The other cables are 1:1 connections and are not described here.

### 11.1. Keyboard Adapter for HiCO486

5-pin DIN Coupler	Signal	10-pin Connector, J4
1	CLOCK	6
2	DATA	5
4	GND	7
5	+5V	4

### 11.2. VGA Adapter for HiCO486

15-pin HD Coupler	Signal	10-pin Connector, J11
1	Red	2
2	Green	4
3	Blue	6
5	GND	10
6	Red GND	1
7	Green GND	3
8	Blue GND	5
13	HSYNC	8
14	VSYNC	9