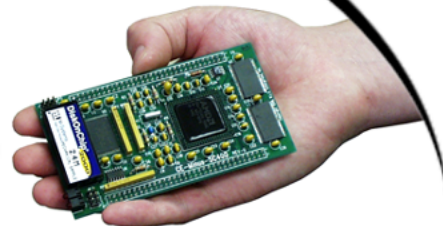


Preliminary  
Data Sheet



***Embedded Single Board Computers***

***Easy To Program***

● ***Microsoft Visual C++***

● ***Microsoft Visual Basic***

## ***CE-Minus***

New from **R.L.C.**, the **CE-Minus-SC400** (486) Embedded Single Board Computer features on a credit card sized board, a complete **Windows CE** engine running your applications written in Microsoft **Visual C++** or **Visual Basic**. Key hardware features include an AMD ELAN SC400 100 MHz 486 compatible CPU/Controller, RAM and Flash Memory, Real Time Clock, Serial Port, Parallel Printer Port, LCD Graphics Controller, PCMCIA Interface, Keyboard Interface, Power Management Unit, and much more. The **CE-Minus** plugs directly into your custom application, or you may use our **CE-Plus** I/O expansion board and **LCD-Plus** LCD Graphics displays with built-in touch screens. A Platform Prototype development board is also available for applications where the **CE-Minus** is to be used stand alone and then designed into a custom application.

### ***Hardware Features***

- \* 32-Bit ELAN SC400 (486) Embedded CPU
- \* 100 MHz Clock Speed
- \* 4 Mega Bytes On-Board Flash Standard
- \* Flash Expandable To 148 Mega Bytes
- \* 16 Mega Bytes On-Board RAM Standard
- \* Power Management Unit
- \* LCD Graphics Controller
- \* PCMCIA Interface
- \* Keyboard Interface
- \* Real Time Clock And Timers (3)
- \* Program Controlled LEDs (2)
- \* Serial Port And Printer Port Interface
- \* I/O Expansion Bus Interface



### ***Software Features***

- \* **Windows CE** Supported
- \* **Visual Basic** Supported
- \* **Visual C++** Supported
- \* On-Board FLASH Programming
- \* I/O Driver Library Provided Free
- \* Demo Programs Provided Free

**TOLL FREE**  
**1-888-RLC-TECH**  
<http://www.RLC.com>

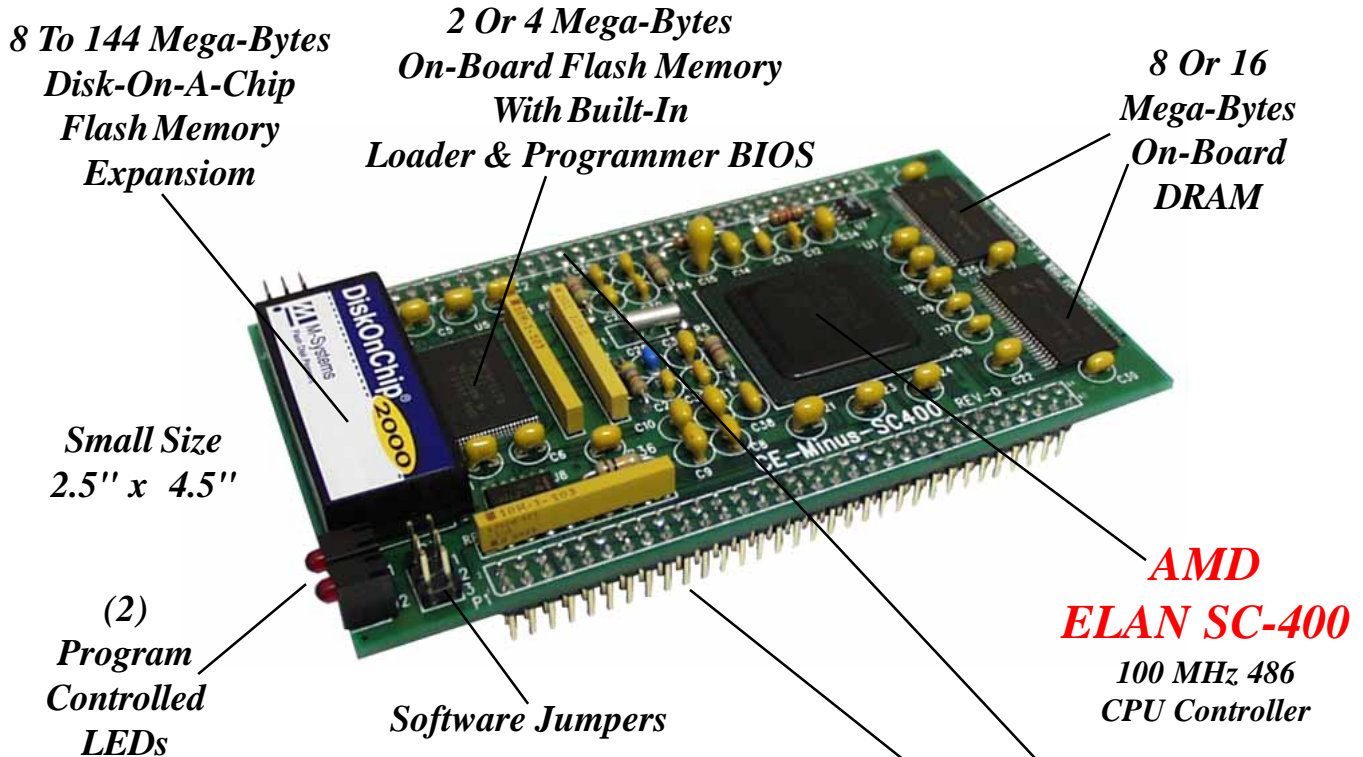
Microsoft and Windows CE is a trademark of Microsoft Corp.

## ***R.L.C. Enterprises, Inc.***

2985 Theatre Drive, Paso Robles, CA 93446 Phone (805) 239-9737 FAX (805) 239-9736

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# CE-Minus



## Off-Board Expansion Connectors P1 & P2

Serial Port (COM-1)	Printer Port (LPT-1)	LCD Graphics Controller	Data Lines (16)	Address Lines (16)	Control Lines	PCMCIA Controller Interface	Chip Selects & Interrupts	Matrix /XT/AT Key Board Interface
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**RTC**  
**Battery**  
**Back-Up**

**(2) LEDs**  
**Software**  
**Jumpers**  
**(3)**

**Reset**

**Max-704**  
**Power**  
**Supervisory**  
**Circuit**

**CPU Bus**

**8 / 16**  
**Mega-Bytes**  
**DRAM**

**FLASH**  
**EPROM**  
**Built-In**  
**BIOS**  
**2 / 4**  
**Mega-Bytes**

**AMD ELAN SC-400 (486)**  
**100 MHz 32-Bit Embedded CPU**  
**Real Time Clock, (3) Timers, DRAM Controller,**  
**Interrupt Controller, Chip Select Controller,**  
**LCD Graphics Controller, Power Management**  
**Unit, PCMCIA Controller. COM Port, Printer**  
**Port, & More.**

**Disk-On-A**  
**Chip**  
**Flash Disk**  
**8-144**  
**Mega-Bytes**

# Hardware Description

## AMD ELAN-SC400

The **CE-Minus** features the ELAN SC400 microcontroller/CPU which combines a 100 Mhz 32-bit, low-voltage 486 CPU with a complete set of PC/AT compatible peripherals, along with the power management features required for low power and battery operation. Fully integrated compatible peripherals include an LCD character/graphics controller, PCMCIA controller, matrix keyboard interface, XT keyboard interface, two 8259A compatible programmable interrupt controllers (PICs), DRAM controller, two 8237A compatible DMA controllers, 8254 compatible timer, 16550 UART, IrDA controller, real-time clock (RTC), and an enhanced parallel printer port. The ELAN SC400 microcontroller/CPU is targeted specifically for embedded systems. All software written for the x86 architecture family is compatible with the ELAN SC400 microcontroller/CPU.

## On-Board Memory

The **CE-Minus** provides up to 16 Mega-bytes of DRAM and 148 Mega-bytes of on-board Flash memory. A 32 pin socket is provided for adding a Disk-On-A-Chip to expand the 4 Mega-bytes of standard on-board Flash memory up to 148 Mega-bytes. A BIOS with built-in loader and Flash programmer is contained in a protected region of the on-board Flash memory. The BIOS allows programs to be down loaded and programmed directly into the Flash memory without the use of external EPROM programmers. You may down load through the RS-232 port using the provided program down loader which runs on any standard Windows compatible computer.

## Serial Port

The **CE-Minus** provides a standard 16550A UART via the ELAN-SC400 CPU. The UART can be used to drive a standard serial interface or a 2-pin infrared interface. The serial interface and infrared interface signals are available on the ELAN SC400 microcontroller at all times, though only one is available at any given time. This interface is available for user integration at P1 and P2.

## LCD Graphics Controller

The **CE-Minus** features an LCD character/graphics controller via the ELAN SC400 CPU/microcontroller. This on-board character and graphics controller is supported for 320 x 240 monochrome 2 bits per pixel, and RGB color 4 bits per pixel. Device drivers for both display types are included and have been custom integrated into the Windows RLC-CE operating system. This interface is available for user integration at P1 and P2.

## Parallel / Printer Port

The parallel port provided by the **CE-Minus** via the ELAN SC400 is functionally compatible with IBM PC/AT and PS/2 systems, with an added EPP mode for faster data transfers. The parallel port interface provides all the status inputs, control outputs, and the control signals necessary for the external parallel port data buffers. This interface is available for user integration at P1 and P2.

## PCMCIA Interface

The PCMCIA Card host bus adapter interface included on the **CE-Minus** via the ELAN SC400 microcontroller conforms to PCMCIA Standard Release 2.1. The interface provides support for one external card socket. This interface is available for user integration at P1 and P2.

## Other Features

Additional functions and features provided by the ELAN SC400 include a Real Time Clock, two 8259 compatible interrupt controllers, 8254 timer, dual 8237 DMA controllers, matrix/XT keyboard interface, and a power management unit. Many of these features are made available for user integration at P1 and P2.

## User I/O Expansion

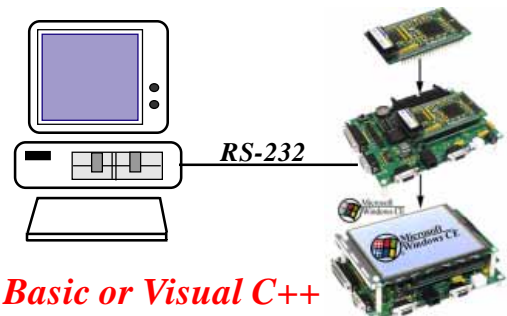
The **CE-Minus** provides address lines, data bus lines, chip selects, interrupts and control lines for interfacing to custom I/O designs. This interface is available for user integration at P1 and P2.

# Software Development

**Windows CE** is a low-cost, compact real time operating system from Microsoft designed for sophisticated 32-bit embedded computer solutions. Windows CE features a compact operating system which has been custom tailored and ported to the CE-Minus-SC400 Embedded Single Board Computer. Many of the interfaces provided by the CE-Minus have been integrated into the operating system. You can write your application programs using off-the-shelf Microsoft Visual Basic or Visual C++ and then add custom drivers and DLL's as required for your specific hardware application. This custom ported version of Windows CE allows the user to write application programs which run directly on the CE-Minus. Additional I/O and Displays are supported and can be added if the application so requires.

Microsoft Visual Basic or Visual C++ and the CE tool kit for Visual Basic or Visual C++ are required for software development. R.L.C. will provide the Windows CE operating

system custom tailored for the CE-Minus along with the SDK that will install into the CE tool kits and allow application programs to be developed for the specific hardware provided by the CE-Minus. An RS-232 cable will allow the target system to communicate to the development computer during program development, debug, and program transfers into flash memory.



**Visual Basic or Visual C++**



# ***CE-Minus Development And Support Boards***



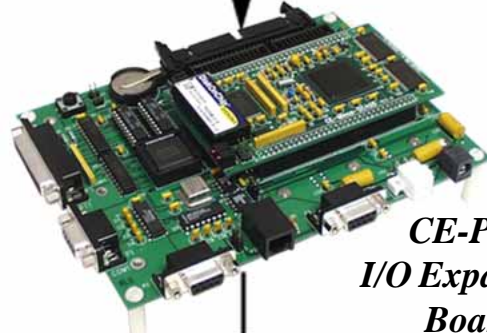
***CE-Minus  
ELAN SC400  
(486)  
CPU Module***



***CE-Minus  
Platform Development Board***



***CE-Minus  
ELAN SC400  
(486)  
CPU Module***



***CE-Plus  
I/O Expansion  
Board***



***LCD-Plus  
1/4 VGA LCD Display  
With Touch Screen***

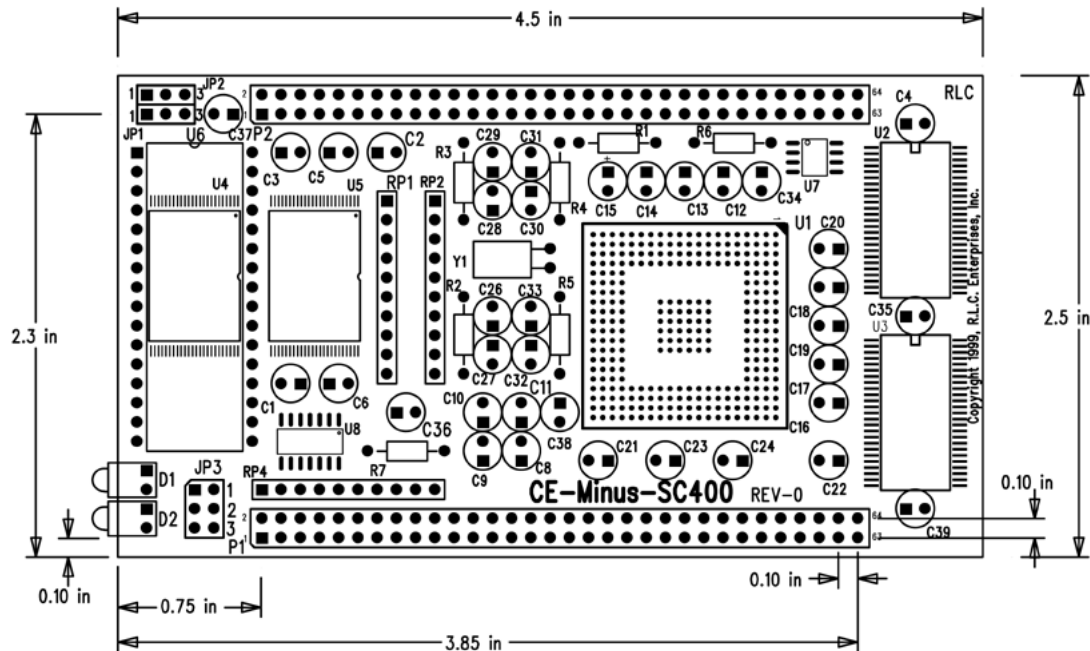
The **CE-Plus** I/O expansion board interfaces directly to the CE-Minus CPU expanding the on-board I/O of the CE-Minus single board computer. The CE-Plus also provides all necessary interfaces needed to set up a Visual C++ or Visual Basic software development environment. The CE-Plus provides the user with all of the features of the CE-Minus plus an on-board regulated power supply as well as data bus buffers, I/O drivers and connectors needed to interface to the many functions provided by the CE-Minus. The CE-Plus I/O expansion board also provides two additional serial ports using a 16C552 dual UART. The CE-Plus I/O expansion board provides for I/O expansion via the two on-board iSBX direct plug-in I/O connectors and the RS-485 Network port. You may add any combination of R.L.C. iSBX I/O Modules and Network I/O Modules to your system using the interfaces provided by the CE-Plus I/O expansion card.

The **LCD-Plus** is a complete LCD display system providing all the necessary interfaces needed to integrate the CE-Minus and CE-Plus to the 1/4 VGA graphics LCD display with optional built-in touch screen. Both Monochrome with gray scales and RGB color models are

available. All bias and backlight power requirements are generated on-board. Contrast is software programmable. An eight by eight matrix keyboard port is also provided for adding external keyboards or switch panels. Six channels of 12-bit A to D conversion on the touch screen models, are available for the user's application.

The **CE-Minus-DEV** platform development board, provides all of the necessary hardware interfaces needed to develop software and hardware applications for the CE-Minus. This board is a useful development tool when the CE-Minus is to be integrated directly into a custom application. If more I/O functionality is required, the CE-Plus I/O expansion board may be used instead. The CE-Minus-DEV development board provides only the necessary power supplies, reset button, parallel printer port, serial port, and a prototype area. These are the minimum hardware interfaces required to set up an environment for software development using Visual C++ or Visual Basic on the CE-Minus. All of the signals and functions provided by the CE-Minus are brought out to the prototype area to be used for custom hardware applications.

## Mechanical Specifications



## External Interfaces (P1 & P2)

The AMD ELAN SC400 microcontroller provides many useful interfaces that are made available for custom design applications. These interfaces are provided by the CE-Minus at connectors P1 & P2. All interface signals are provided directly from the on-board ELAN SC400 CPU/microcontroller. The designer should refer to the AMD SC400 data sheets for proper interface specifications. The CE-Plus I/O expansion board from R.L.C. provides buffers, and additional circuitry necessary to interface to many of these features. The CE-Plus also may be used in your application and schematics are available and may be useful when designing your own custom application board.

### Serial Port:

Standard PC compatible Rx, Tx, RTC, CTS, and Infrared port.

### Parallel Printer Port:

Signals provided to implement enhanced parallel printer port.

### Graphics Controller Interface:

Complete monochrome and Color LCD character/graphics interface controller.

### PCMCIA Interface:

Signals provided to implement one PCMCIA interface to support I/O cards and ATA Flash memory cards.

### Keyboard Interface:

XT/SCP/Matrix.

### User I/O Expansion Interface:

Data, Address, Interrupts, Chip Selects, And Control.

## General Specifications

### Power Requirements:

Regulated 3Vdc with maximum memory.  
90 ma. @ 33Mhz./Idol, 520 ma @ 100 Mhz.

Regulated 5Vdc power with maximum memory.  
2 ma @ 33 Mhz./Idol, 19 ma. @ 100 Mhz.

### Environmental:

-0 to +85C with air flow and no condensation.

### CPU Clock Speed:

AMD ELAN SC400 running at 33/66/100 Mhz. Software selectable and automatic power management.

**Special Order :** R.L.C. will, on special request, re-design the **CE-Minus** to include the I/O functions and interfaces required by your application. Size and shape may also be changed to your specifications. Special orders will require minimum quantity purchases and/or NRE charges.