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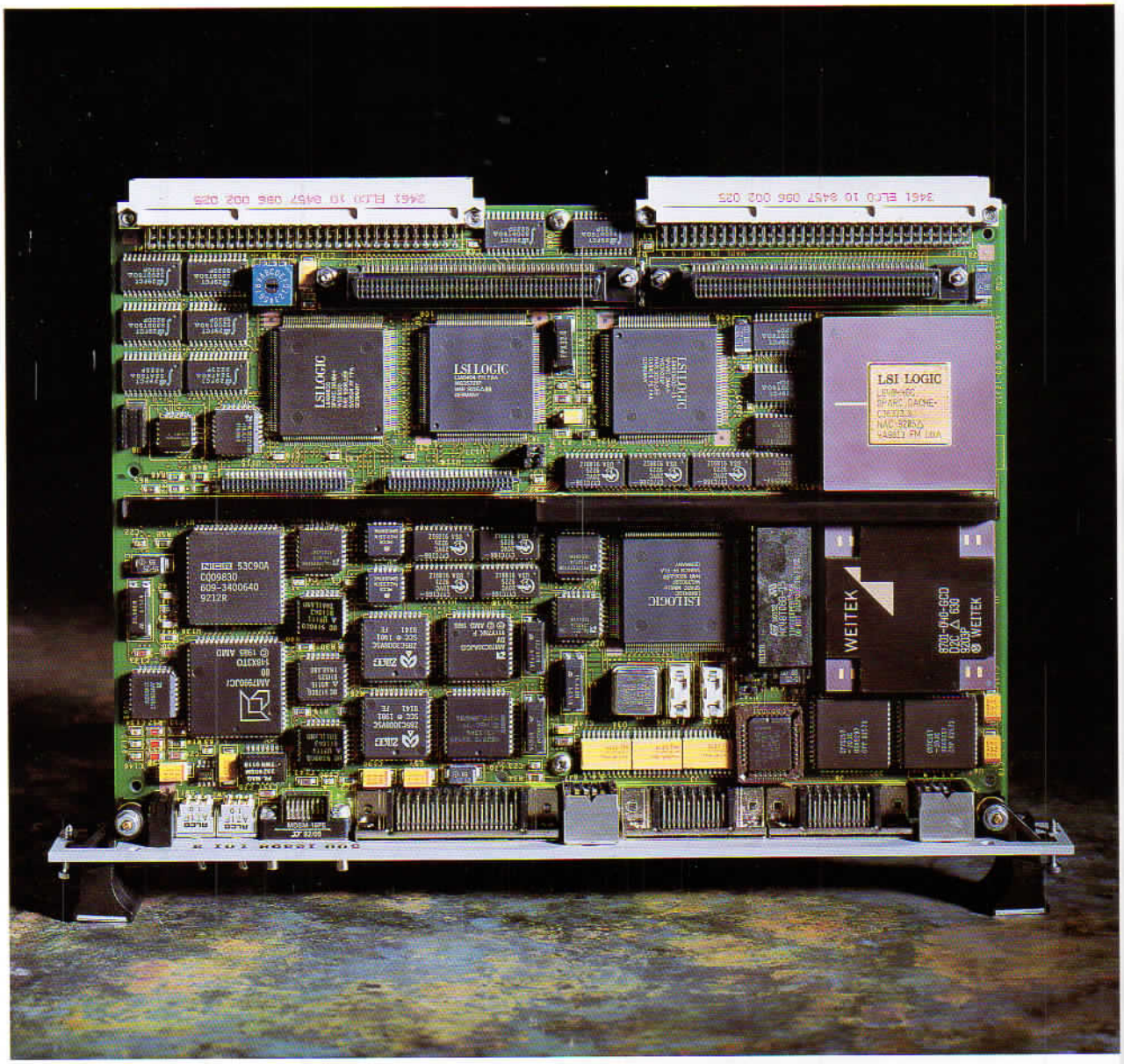
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Find the *Emerson / Motorola / Force Computers SPARC CPU-2CE/16* at our website: ***Click HERE***

SPARC CPU-2CE

A complete VMEbus-based SPARCstation 2 architecture with SBus expansion.



The SPARC CPU-2CE™ is the first new design resulting from the technology partnership of FORCE COMPUTERS and Sun Microsystems. Combining a true SPARCstation™ 2 architecture with FORCE COMPUTERS expertise and experience in standard 6U Eurocards has resulted in a faithful SPARCstation 2 implementation in a single VMEbus slot.

The SPARC CPU-2CE offers the same I/O interfaces as the SPARCstation 2, including DMA supported SCSI and Ethernet ports along with audio, keyboard/mouse and two serial channels with full modem support. Two SBus sockets allow the installation of standard, off-the-shelf SBus modules such as graphic frame buffers or accelerators or any of over 300 SBus cards available from third-party vendors.

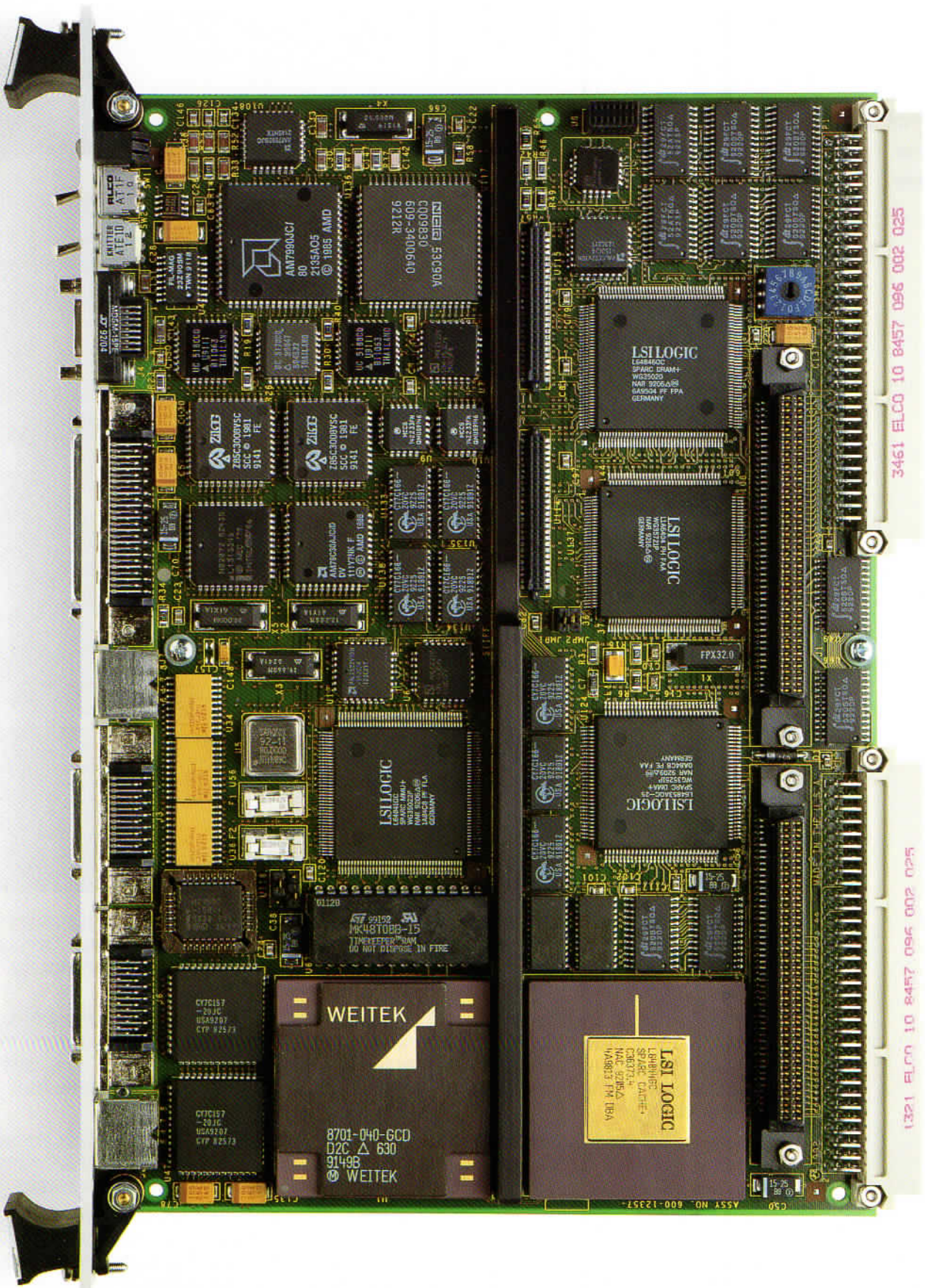
Through its binary compatibility with the Sun SPARCstation 2 family, the SPARC CPU-2CE runs current versions of SunOS™/Solaris™ as well as the more than 4,000 shrink-wrapped SPARCware™ applications available today. In addition, a variety of real-time operating systems are available.

Its IEEE 1014–compatible VMEbus interface enables the SPARC CPU-2CE user to build high-performance embedded UNIX® systems, SPARC®-based real-time systems and hybrid UNIX/real-time systems linked via the VMEbus or local- and/or wide-area networks. The SPARC CPU-2CE is a compact single board computer that brings the power and functionality of the popular Sun SPARCstation 2 to the industry-standard VMEbus for use in UNIX and real-time applications.

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SPARC CPU-2CE

OVERVIEW



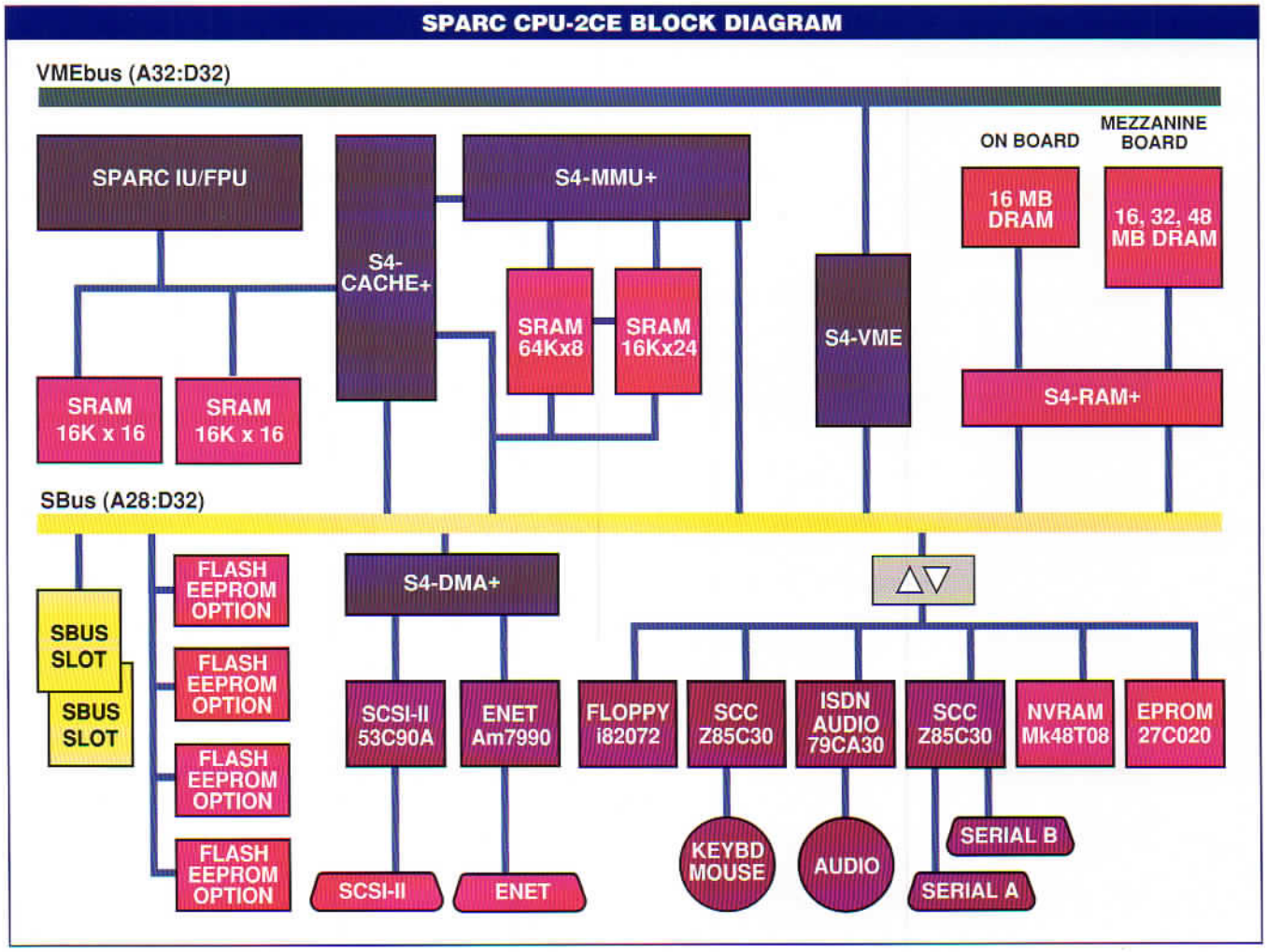
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Features

- Binary compatibility to Sun SPARCstation 2 family
  - 28.5 MIPS SPARC RISC, 4.2 MFLOPS double-precision floating microprocessor at 40 MHz, 64-KByte cache
  - High-performance Ethernet interface
  - SCSI-II bus expansion and floppy disk controller
  - Two synchronous/asynchronous serial I/O ports
  - Keyboard/Mouse and audio ports
  - Battery–backed up nonvolatile RAM and TOD clock
  - OpenBoot™ PROM firmware
  - Completely SunOS/Solaris compatible
- 16 to 64 MBytes of on-board DRAM
- Optional 256-KByte FLASH EEPROM
- Two SBus expansion sockets
- P2 connection for floppy, SCSI, speaker and LED
- 32-bit VMEbus, IEEE-1014, SPARC CPU-1E compatible

Benefits

- Full SPARCstation 2 architecture in a single VMEbus slot for a wider variety of packaging options
- Runs all SPARCstation software
  - SPARCstation 2 performance
  - Binary I/O compatibility
  - Boots directly from Sun CD-ROM or tape
- Easy integration with industry-standard 6U VME products
- Full support for memory intensive applications
- Powerful real-time processing capabilities
- Designed for a range of embedded, industrial and rugged environments
- Wide range of I/O expansion via the VMEbus and SBus capabilities
- Performance upgrade from SPARC CPU-1E (FORCE COMPUTERS) and SPARCengine™ 1E (Sun Microsystems)



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SPARC CPU-2CE
HARDWARE DESCRIPTION

Main Processor Unit

A 40-MHz SPARC (Scalable Processor ARChitecture) 32-bit RISC processor chip set is at the core of the SPARC CPU-2CE. It is comprised of an integrated Integer Unit/Floating Point Unit (IU/FPU), a Sun standard SRAM-based Memory Management Unit (S4-MMU+), a Cache Controller (S4-Cache+) and two Cache RAM chips. Operating at 40 MHz, the IU/FPU provides 28.5 MIPS integer performance and 4.2 MFLOPS floating point performance. The Cache Controller provides a 2-KByte tag array for a 64-KByte, virtual, write-through cache.

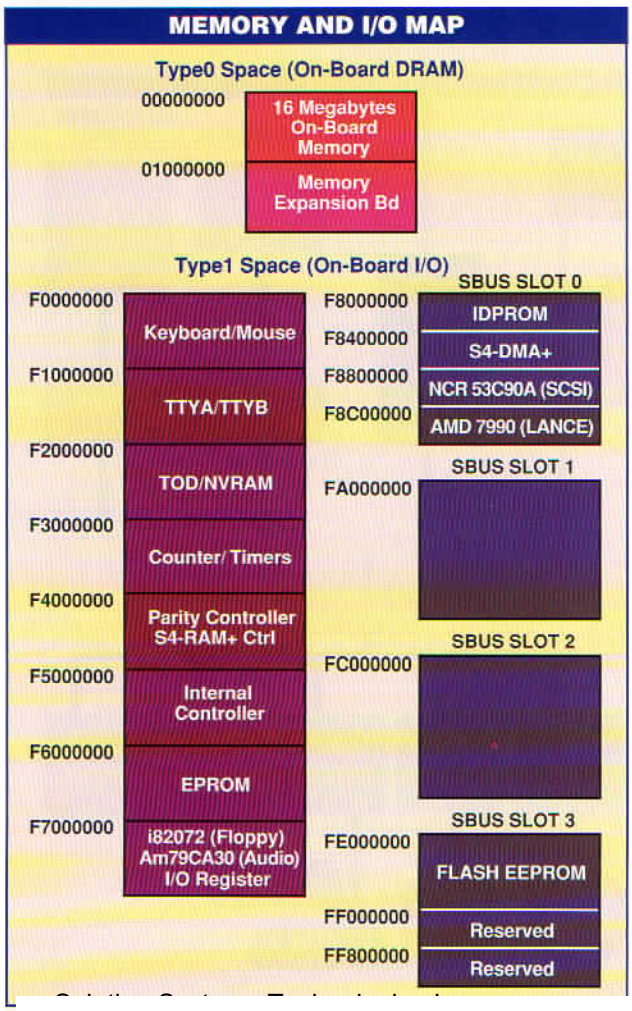
Memory Subsystem

DRAM

The SPARC CPU-2CE chip set includes the S4-RAM+, an SBus-compatible DRAM controller with single clock burst capability. S4-RAM+ operates the DRAM in fast page mode to support 8-, 16-, 32-, and 64-byte bursts at one transfer per clock after an initial access latency of 4 clocks for reads and 2 clocks for writes. The configuration supports up to 64 MBytes of 32-bit wide DRAM on board and incorporates parity generation and parity error detection.

The SPARC CPU-2CE is available with 16, 32, 48, or 64 MBytes of on-board DRAM. 16 MBytes reside on the base board and are implemented using high-reliability TSOP devices. Additional capacity upgrades are achieved using separate mezzanine modules which retain the single-slot capability without interfering with SBus expandability on the SPARC CPU-2CE.

Memory can be expanded beyond the 64-MByte on-board limit via an SRX-2 card. This option expands Type0 memory space by up to 64 MBytes and is cacheable, an advantage over other SBus-based memory expansion modules. Further memory expansion is possible via standard VMEbus memory boards, such as SYS68K DRAM series.



Boot EPROM

The supplied boot EPROM contains an implementation of OpenBoot PROM that is fully compatible with the available SPARCstation 2 functionality. An FCODE interpreter is provided, along with enhancements to support initialization and reconfiguration of the VMEbus interface and on-board FLASH EEPROM. The devices are socketed to allow installation of user supplied, custom EPROM capabilities.

Optional FLASH EEPROM

In addition to the boot device, the SPARC CPU-2CE employs FLASH EEPROM in TSOP packaging for flexibility and customization. A minimum of 256 KBytes is optionally provided and is mapped in place of the Sun SPARCstation 2 SBus Slot 3.

This EEPROM is erasable and writable by the user and allows the system integrator to incorporate FCODE drivers for system specific VME-based products using routines supplied in the boot ROM. With 150 ns EEPROM, the access time is 4 clocks.

The FLASH EEPROM is accessible from the VMEbus in "Configuration" space. This capability allows SPARC CPU-2CE integrators to specify their product as the console or boot device without having to modify the on-board firmware. It also allows them to take advantage of SunOS loadable drivers for their VME products. This feature provides a path to firmware-assisted system auto-configuration.

Local I/O

Ethernet and SCSI-II interfaces, two serial interface ports, a keyboard serial port, a mouse serial port, a floppy disk controller, and an audio input / output port are provided.

Serial Interface Ports

The Zilog Z85C30 Serial Communications

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using 26-pin Micro-D connectors on the front panel for synchronous and asynchronous communications. Data rates up to 64 Kbaud are supported and are user configurable, with a pluggable shunt for either RS-232C or RS-423C, and offer full modem control and interrupt capability.

Keyboard/Mouse Port

The connector for the keyboard/mouse port uses a SPARCstation type 8-pin Mini-circular DIN connector on the front panel. The Z85C30 SCC for the keyboard/mouse port is terminated with TTL buffers and uses all TTL-compatible data signals. The interface is fully compatible with Sun SPARCstation 2 keyboard and mouse product offerings and uses the same cables.

Floppy Disk Controller

An Intel i82072 functions as the floppy disk controller and is fully compatible with the Sun SPARCstation 2. The floppy disk controller signals are available on the User I/O lines of the P2 connector.

Audio Port

The audio interface is implemented with an AMD Am79CA30 ISDN/audio controller device and is fully compatible with the Sun SPARCstation 2. The audio connector on the front panel is an 8-pin Mini-circular DIN connector. As in the SPARCstation 2, the ISDN functionality of the Am79CA30 is not fully implemented.

Ethernet Port

The Ethernet interface is comprised of the S4-DMA+ interface chip for DMA, the AMD Am7990 Local Area Network Controller (LANCE) chip and the AMD Am7992B Serial Interface Adapter (SIA). The IEEE 802.3 Ethernet interface is available via a 15-pin Micro-D connector on the front panel. The S4-DMA+ chip contains a 32-byte FIFO and increases performance through its 16-byte DMA burst capability.

SCSI-II Interface

The Small Computer System Interface (SCSI) uses the NCR 53C90A controller chip and is augmented by the S4-DMA+ chip. It is fully compliant with SCSI specification, ANSI x3.131. This allows the SPARC CPU-2CE to control and access a wide variety of mass storage devices.

Up to seven logical SCSI devices may be connected to the SPARC CPU-2CE. The SCSI bus is buffered and terminated, making SCSI device connections simple and straightforward. Both synchronous and asynchronous operations are fully supported. For versatility and flexibility, the SCSI bus on the SPARC CPU-2CE is routed both to the front panel via a 50-pin SCSI-II connector and to the board's P2 User I/O pins. SCSI bus termination is automatically disabled if connections to the front panel and P2 ports are made simultaneously.

Sun Microsystems Computer Corporation® and FORCE COMPUTERS Inc.® announced an alliance in 1991, giving FORCE COMPUTERS Inc. the license to manufacture, market, and sell Sun boards based on SPARC and SunOS, the Sun UNIX development environment. Now embedded systems designers can work with VMEbus and Futurebus/Plus™ boards based on the most popular UNIX development systems and the latest SPARCstation system technology.

Real-Time Clock and NVRAM

The SPARC CPU-2CE board uses the Mostek Mk48T08 RTC-NVRAM chip. This device includes an 8-KByte nonvolatile static RAM, of which 6 KByte is user accessible, and a clock/calendar circuit. Both are supported by a 10-year shelf-life lithium battery in order to retain data when the board is powered down.

CONNECTORS

Function	Manufacturers' PN	Location
SCSI-II	AMP 749831-5	Front Panel
Ethernet	ITT CAN MDSM-15PE-Z10	Front Panel
Serial I/O	AMP 749830-2	Front Panel
Audio	AMP 749232-1	Front Panel
Keyboard/ Mouse	AMP 749232-1	Front Panel
SBus	Fuj FCN234J096G V	SBus Slots 1, 2

SBus Interface

The SBus is a high-performance expansion bus with a bandwidth of over 50 MBytes/sec. The SPARC CPU-2CE SBus implementation features 32-bit virtual addressing, 28-bit physical addressing, 32-bit data path, synchronous data transfer and master/slave capability. The SPARC CPU-2CE incorporates two SBus sockets for I/O expansion. These provide support and compatibility with the hundreds of third-party SBus expansion products on the market, including products for video and graphics, connectivity and networking, manufacturing and process control, engineering, and scientific instrumentation.

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SPARC CPU-2CE

VMEBUS INTERFACE/SOFTWARE DESCRIPTION

VMEbus Interface

The SPARC CPU-2CE utilizes the Sun S4-VME chip to provide a complete 32-bit VMEbus interface. Since this is the same device used on the SPARC CPU-1E from FORCE COMPUTERS (SPARCengine 1 from Sun Microsystems) system performance upgrades with minimal software changes are guaranteed. Supported functions include master and slave data transfer capabilities, and VMEbus interrupt handling and arbitration functions. Additional VMEbus utility functions and a special loop-back cycle for standalone testing of the interface are provided.

The VMEbus interface on the SPARC CPU-2CE is fully supported by a driver for the SunOS/Solaris operating system. The software support also includes an implementation of the ONC/VME protocol which supports standard networking protocols such as TCP/IP, NFS, and RPCs across the VMEbus backplane. (See Software Description.)

Master Interface

The VMEbus master interface allows 16-, 24-, and 32-bit addressing with 16- and 32-bit data transfers. A full 4-GByte address range is available and may be mapped contiguously without the 512-MByte limitation typically imposed by the 28-bit SBus definition. This is done by directing normally unused MMU signals to VMEbus decoding logic, external to the S4-VME chip. A software switch enables the standard S4-VME 512-MByte address mode with window mapping registers. This 28-bit mode emulates the SPARC CPU-1E VMEbus addressing scheme, allowing customers a migration path to help preserve a previous investment in custom VMEbus drivers.

Read-modify-write cycles are supported for master accesses, and a 300 µsec VMEbus timer is included. Unaligned transfers are not supported by the S4-VME chip.

Slave Interface

Access to the on-board DRAM is allowed to a 1-MByte page configurable on 1-MByte boundaries within the local address space. Addressing is recognized for both 32- and 24-bit standard accesses, with 16-bit accesses reserved for the mail box interrupt. Address modifiers are supported, and any slave access as a DVMA device is set to the local supervisor mode in accordance with the Sun-4™ architecture. The 1-MByte VME address space selected is always mapped to the highest megabyte in the virtual address space in accordance with the Sun-4 architecture. Unaligned slave accesses are not supported by the S4-VME chip.

A mail box interrupt function allows other VMEbus devices to interrupt the SPARC CPU-2CE. This mail box detects accesses to the specific A 16 address space set in the mail box register. Mail box accesses are acknowledged as standard VMEbus cycles, and trigger an on-board level 13 interrupt.

Interrupts

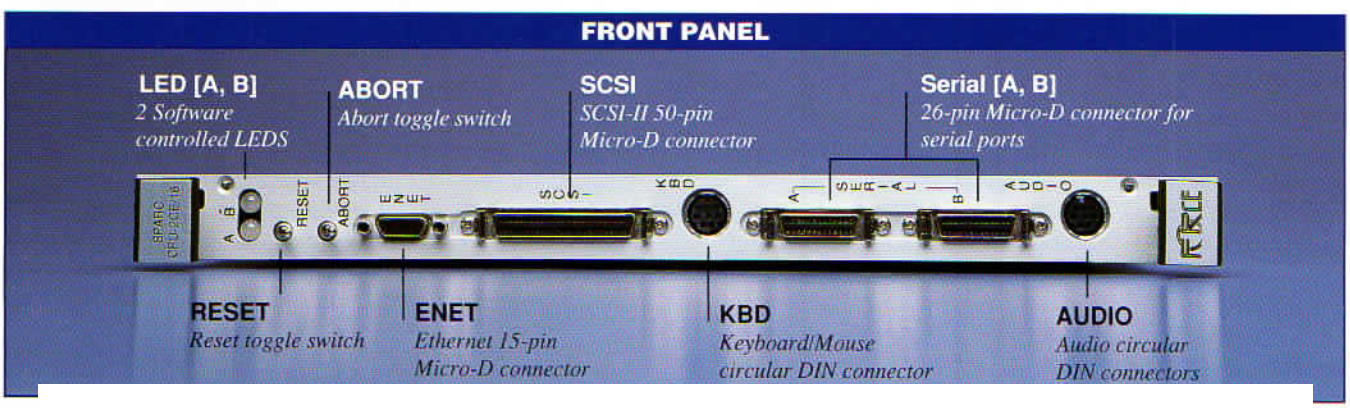
The on-board interrupt handler selectively supports all seven VMEbus interrupt levels which are routed directly to the S4-MMU interrupt logic. Control of interrupts is handled via software in the interrupt enable register.

System Controller

The SPARC CPU-2CE is capable of providing all Slot 1 system controller functions. The S4-VMEbus requestor is a release on request (ROR) requestor. Bus requests are made on BR3.

The VMEbus arbiter function is used when the SPARC CPU-2CE is configured for system controller functions (Slot 1 jumper). Both single-level (SGL) and round robin (RRS) arbitration are provided. Bus timer logic is included to prevent a VMEbus lockup to a non-responding bus requestor or to a non-existent slave device.

Additional system VMEbus controller functions are automatically activated when the Slot 1 jumper is enabled. These capabilities include: IACK Daisy Chain Driver, SYSRESET, SYSFAIL and SYSCLK.



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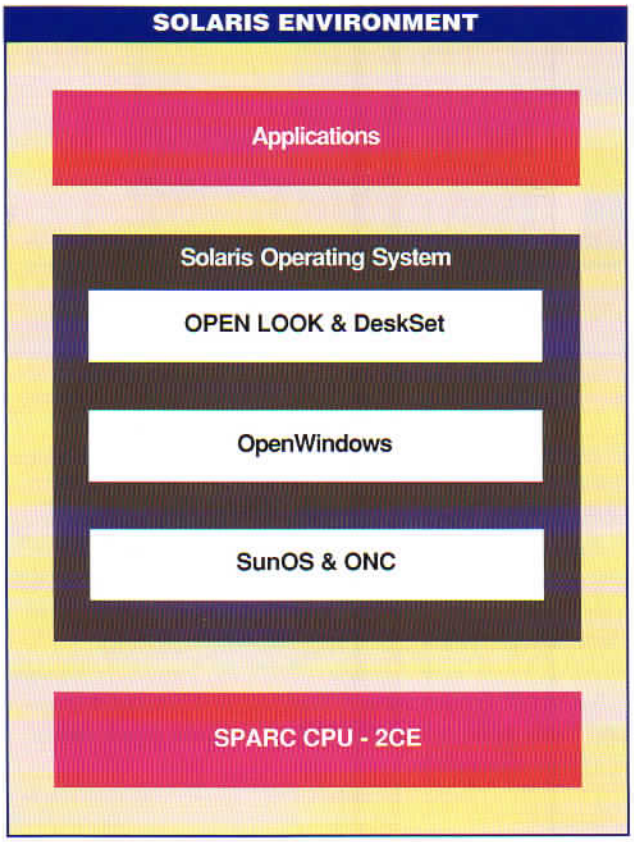
SOFTWARE DESCRIPTION

Software Description

With full binary SPARCstation 2 compatibility, the SPARC CPU-2CE runs the Solaris operating system, including enhancements specific to the Sun SPARCstation product line. Solaris provides an advanced development and run-time environment for the SPARC CPU-2CE. As the first "shrink-wrapped" distributed computing solution, Solaris is comprised of SunOS, ONC™ networking environments, OpenWindows™, OPEN LOOK® and DeskSet™. SunOS is the highest quality and most widely supported enriched UNIX implementation available today.

ONC is the industry standard for heterogeneous networking. OpenWindows is the network-extensible graphical application development platform. OPEN LOOK is an intuitive graphical user interface, and DeskSet is a suite of personal and work group productivity applications.

By carefully merging the most robust functionality of UNIX System V™, Berkeley BSD™, and Xenix™; SunOS offers the optimum balance of UNIX capability, reliability, and performance. Further functionality includes:



- Standards Conformance (POSIX, X/Open, XPG, SVID and FIPS)
- The OpenWindows "Look and Feel" Graphical User Interface
- Hierarchical and consistent format file system that includes support for MS-DOS®, CD-ROM and RFS, among others
- ONC networking environment for distributed computing across multivendor networks
- Enhanced UNIX kernel with internationalization, system accounting, security, and redundancy
- A comprehensive range of third-party software that include databases, design automation, and artificial intelligence
- VMEbus driver configured for Sun-4/SPARCserver™ type expansion interface allowing the use of existing Sun-compatible VMEbus device drivers

Development

By using the SPARC CPU-2CE as both the development and the target system, equipment costs, and time-to-market can be reduced. Solaris on the SPARC CPU-2CE provides all the tools necessary to take a project from conception through delivery. This includes: project planning aids (e.g. mail, diary, print facilities, etc.); design aids (e.g. compilers, assemblers, debuggers, and libraries); test facilities (e.g. compliance checkers, performance monitors, profilers, and system diagnostics); documentation tools (e.g. text formatters, print filters, and PostScript® interfaces); archiving and maintenance (e.g. source-code control systems, archivers, and backup systems); and others.

Optimizing compilers available from Sun include: C, C++, FORTRAN-77, Pascal, Modula-2, and Common Lisp. Independent software developers furnish many other languages, including Ada, APL, BASIC, COBOL, Forth, Mainsail, PL/I, and Prolog. Sun languages have full access to systems, graphics, networking, and user interface packages. Third-party cross compilers allow C, FORTRAN, or Pascal programmers to produce executable binary code for multiple architectures from a single FORCE SPARC CPU-2CE.

Sun Tools

Standard software provided with Solaris includes a powerful user interface. This allows access to Solaris resource management functions, as well as industry-standard UNIX editors, command shells, and all UNIX commands for file management and manipulation, system administration, I/O system control, and other software development tools.

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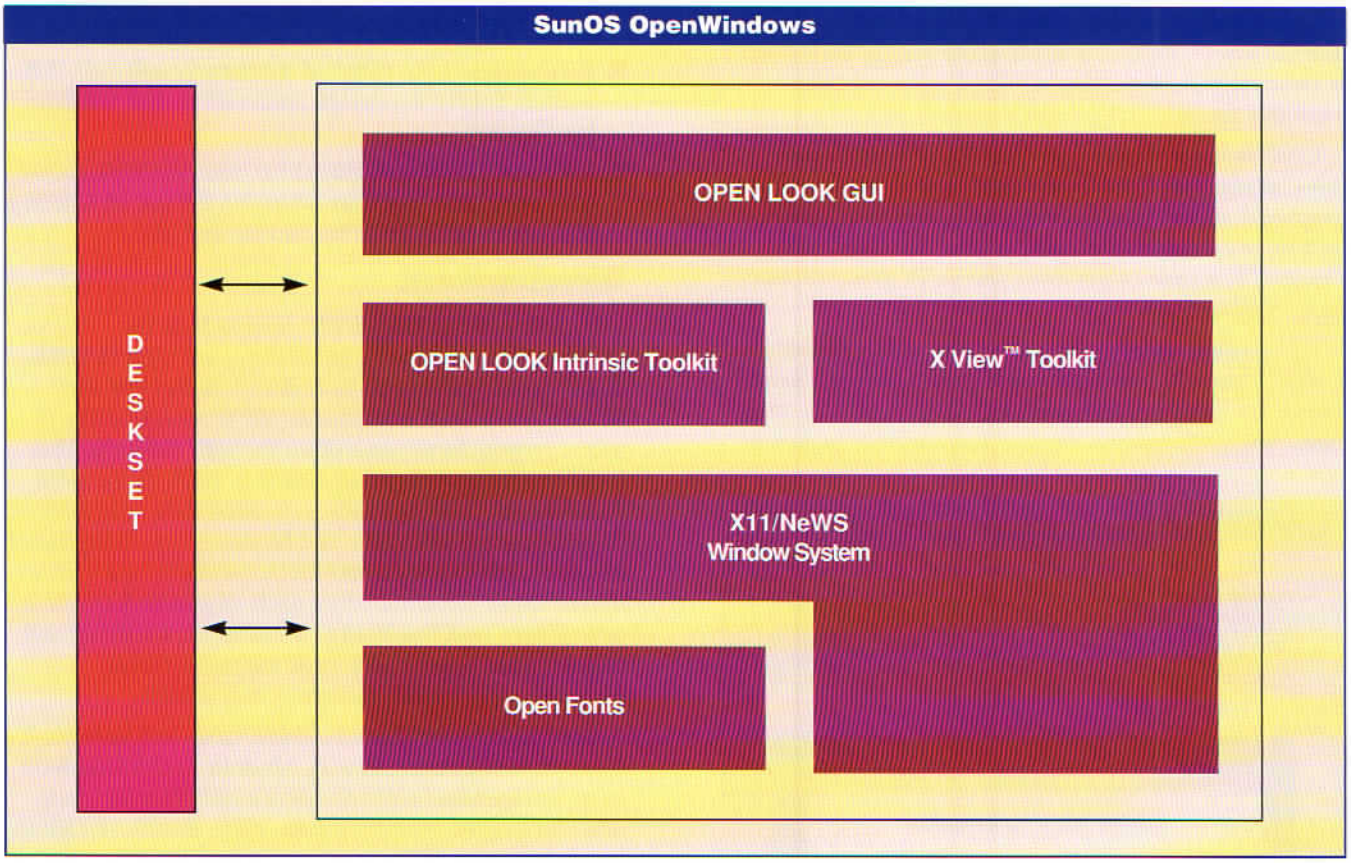
SPARC CPU-2CE
SOFTWARE DESCRIPTION

Graphical User Interface

OpenWindows is a full-featured windowing environment based on the X-Window standard and the NeWS®. OPEN LOOK is a graphical user interface that uses X-Windows and NeWS to provide an intuitive, "look and feel" desktop. The DeskSet is a group of personal productivity tools and system service applications which includes a File Manager, Calendar, Debugger, Mailer, and others.

The Remote Procedure Call (RPC) is the core of ONC and is used to build services such as the NFS®, Network Information Service (NIS), and Network System Boot.

Solaris also supports an extensive set of networking tools that allows developers to take advantage of industry standards. Solaris supports internet protocols, including raw (IP), datagram (UDP/IP) and stream (TCP/IP). User-accessible interfaces allow development



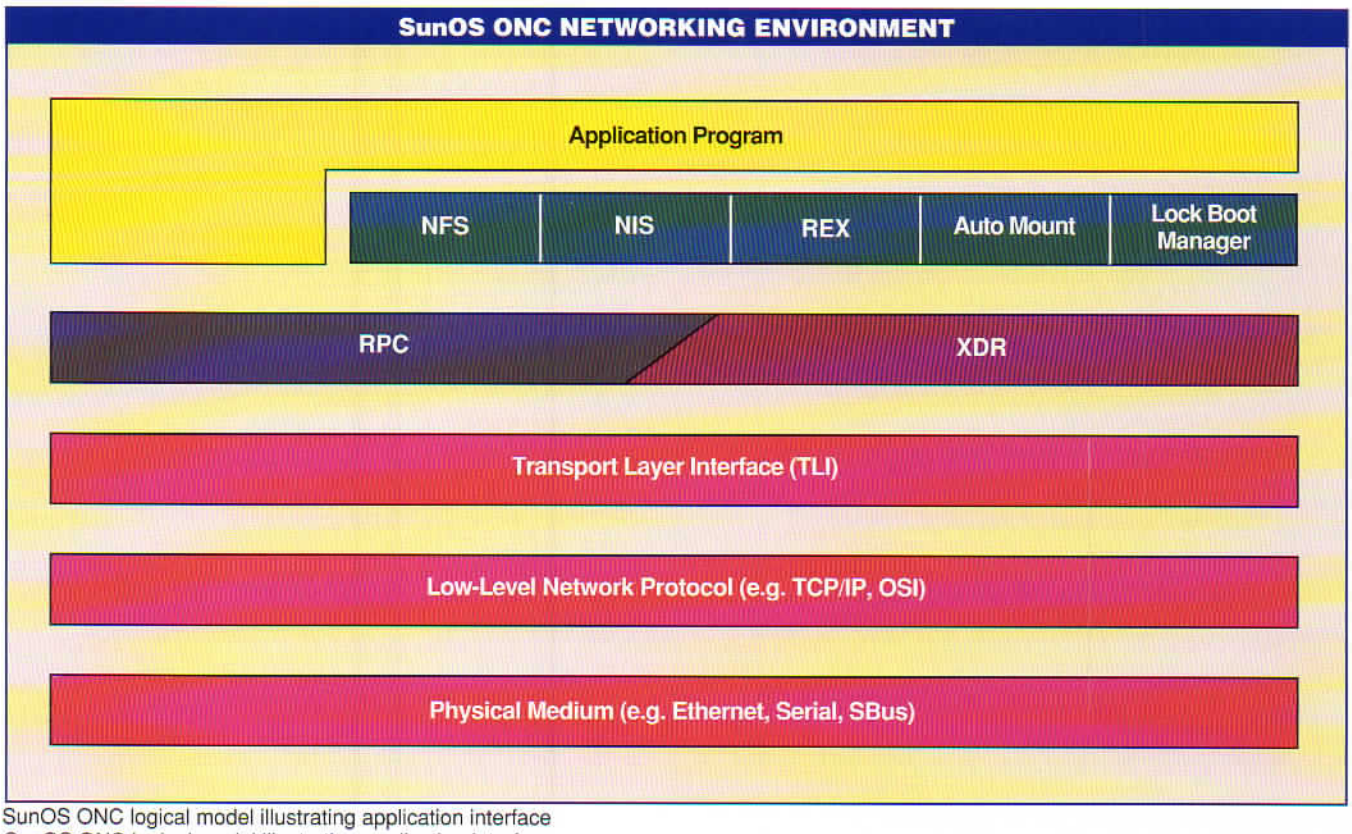
Networking

ONC networking environment is a suite of software modules and services that are the de facto standard for distributed computing. FORCE COMPUTERS provides a VMEbus driver utility as a standard item in conjunction with the Solaris operating system. This driver combines the core of the Sun-4 SPARCserver treatment of the VMEbus expansion interface with the additional capability to run ONC over the VMEbus backplane. This provides an optimal platform for both tightly coupled networking and distributed processing applications, as well as the ability to readily adapt existing drivers for add-in VMEbus peripheral controllers.

of custom interfaces and protocols. Solaris also provides a Serial Line Internet Protocol (SLIP) for serial line–based wide-area networks (WANs).

Optional software provides support for: DECnet; SNA, including IBM's Advanced Program-to-Program Communications (APPC) and Document Interchange Architecture (DIA); OSI support which adheres to MAP 2.1 and TOP 1.0 specifications, Layers 1 through 7 for MAP applications; FTAM (File Transfer Access and Management); and CASE (Common Application Services Elements).

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SunOS ONC logical model illustrating application interface
SunOS ONC logical model illustrating application interface

Real-Time

The SPARC CPU-2CE with Solaris, which supports a wide range of VMEbus and SBus-based hardware and software solutions, creates an ideal embedded system. New releases of Solaris provide the SPARC CPU-2CE with real-time extension for use in "soft" real-time applications. These extensions include: fixed priority processes, priority manipulation, pre-emptive scheduling, process priority inheritance, guaranteed dispatch latency, and memory locking.

A variety of "hard" real-time operating systems, including VxWorks™ and LynxOS™ are available on the SPARC CPU-2CE. Additional products including VRTX™, Chorus™, pSOS+, OS-9000™, and others are planned for future availability. These systems typically provide high-speed multitasking, pre-emptive scheduling, and fast interrupt response. They include facilities for intertask communicaitons and synchronization, efficient memory management, system clock and timing, optimized floating point support, and high-performance I/O and file systems. Real-time development tools usually include an interactive debug Shell, a linking loader, symbolic debugger, performance monitor, exception and signal handling, libraries, utility routines, extensive system and task information utilities, and source level debuggers.

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SPARC CPU-2CE

SPECIFICATIONS/ORDERING INFORMATION

SPECIFICATIONS

CPU Type	SPARC RISC
Clock Frequency	40 MHz
Integer Performance	28.5 MIPS
Floating Point	4.2 MFLOPS, Double Precision
Cache: Data and Instruction	64 KBytes
DRAM TSOP	16 MBytes
Error Detection	Byte Parity
Local RAM Expansion (Single slot)	16 or 48 MBytes via Mezzanine Module
Maximum local DRAM (2 VMEbus slots using SRX-2)	128 MBytes
SRAM (Battery–Backed Up)	8 KBytes
MMU	Sun-4 MMU ASIC
SBus Expansion	2 Sockets
VMEbus Interface	
Master	A32, A24, A16: D8, D16, D32, RMW
Slave	A32, A24: D8, D16, D32, BLT
VMEbus Interrupt Handler	1 through 7 (selectable)
VMEbus Arbiter	4 Level (RRS, SGL)
Multiprocessor Mailbox	Yes (A16 access)
Ethernet (IEEE 802.3)	AMD 7990 LANCE, AMD 7992B SIA
Ethernet Transfer Rate	10 Mbits/sec
Serial Ports	Async/Sync; RS-232C/RS-423C
SCSI Controller	NCR 53C90A and S4-DMA+
SCSI Transfer Rate (Burst)	Async 1.5 MBytes/sec; Sync 5 MBytes/sec
Audio Controller	AMD 79CA30
Floppy Disk Controller	Intel 82072
Keyboard/Mouse	Sun-4 Standard
NVRAM Clock/Calendar	Mk48T08
Boot EPROM	2 Mbit, 8-bit wide
FLASH EEPROM	256 KByte, Optional
Board Size	160 x 233 mm; 6.29" x 9.18"
Power Requirements (Without optional SBus Cards)	+5V 4.0 Amps +12V 0.6 Amp -12V 0.1 Amp
Environments – Operating Temperature	0° C to 55° C
Humidity	20% to 80% noncondensing at 40° C

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CATALOG #	PRODUCT DESCRIPTION
SPARC CPU-2CE/16 #510305	40 MHz SPARC-based 6U VMEbus computer with 16-MByte DRAM, 64-KByte cache, Ethernet, SCSI-II port, 2 Serial channels, Keyboard/mouse port, Audio port, Floppy disk controller and 2 SBus expansion sockets. Includes user's guide, Ethernet cable.
SPARC CPU-2CE/32 #510306	40 MHz SPARC-based 6U VMEbus computer with 32-MByte DRAM, 64-KByte cache, Ethernet, SCSI-II port, 2 Serial channels, Keyboard/mouse port, Audio port, Floppy disk controller and 2 SBus expansion sockets. Includes user's guide, Ethernet cable.
SPARC CPU-2CE/64 #510329	40 MHz SPARC-based 6U VMEbus computer with 64-MByte DRAM, 64-KByte cache, Ethernet, SCSI-II port, 2 Serial channels, Keyboard/mouse port, Audio port, Floppy disk controller and 2 SBus expansion sockets. Includes user's guide, Ethernet cable.
SPARC CPU-2CE/XX (Without FLASH EEPROM) #XXXXXX-1	Removes FLASH EEPROM for SPARC CPU-2CE/XX products. Add "-1" designation to catolog numbers provided above.
DRM-2/16 #510146	16-MByte TSOP DRAM mezzanine expansion board for SPARC CPU-2 family products.
DRM-2/48 #510328	48-MByte TSOP DRAM mezzanine expansion board for SPARC CPU-2 family products.
SRX-2/64 #510304	64-MByte SBus RAM expansion module for SPARC CPU-2 family products. Occupies adjacent VMEbus slot.
SPARC CPU-2CE Accessory Kit #510323	Start-up kit includes SCSI, Serial I/O and Audio cables, SBus-FP, and Technical reference manual.
IOPI #510285	Provides P2 I/O panel connection for SCSI, Floppy, LED and speaker connections. Includes 1M SCSI, Floppy (Sony 3.5") cables. Consult factory representatives for current part number.
SPARC SBus/Monochrome, Frame Buffer #510280	1152 x 900 SBus Video Card for monochrome monitors. Requires SBus-FP (included in accessory kit).
SPARC SBus/Color, Frame Buffer #510281	1152 x 900 SBus Video Card with 8-bits per pixel; 256 colors or shades of gray from a palette of 16 million colors. Requires SBus-FP (included in accessory kit).
SPARC SBus/GX, Graphics Accelerator #510279	1152 x 900 SBus Graphics Accelerator Card with 8-bits per pixel; 256 colors from a palette of 16 million; provides accelerated 2D/3D wire-frame graphics with auto acceleration of applications developed with Sun Graphics Libraries. Requires SBus-FP (included in accessory kit).
CPU-2X Keyboard Kit #510326	Sun-compatible USA keyboard kit. Includes mouse and pad; 15' keyboard cable.
Solaris Media #510301	Solaris Operating Systems including SunOS, OpenWindows, ONC. Please contact a factory representative for current version information. VMEbus driver sold separately (below).
SPARC CPU-2CE VME.DRV #510325	VMEbus driver routines on 1/4" tape and floppy. For use with SPARC CPU-2CE products.
RTU-2/CPU-2X #510296	Two user Right-to-Use License for Solaris and SunOS.

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