Technical Product Summary

Classic R-Series Platforms

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Introduction

The Intel486™ Classic R-Series incorporates a local bus SuperVGA solution in a very affordable i486™ platform. A wide range of CPUs provides immediate performance flexibility and a single 238-pin LIF (Low Insertion Force) processor socket allows upgrades to higher performance in the future.

The 24-bit color local bus graphics capabilities are the highest integrated video solution available. Classic R's solid SuperVGA performance comes from a Cirrus Logic CL-GD5424 located on the i486 local bus. The video subsystem also includes an integrated 24-bit RAMDAC and clock synthesizer.

An easy upgrade path to higher CPU performance is built into the Classic R-Series. The processor socket accepts either an i487™SX to enhance performance with numeric intensive applications, or an OverDrive™ Processor, Intel's upgrade component that doubles the speed of all i486 internal processes. Support for the next generation OverDrive Processor, based on the Pentium CPU, protects today's investment in the Classic R-Series.

With three slots and four bays, Classic R-Series also provides the expandability needed for traditional desktop PC applications. The system integrates hard disk and floppy disk controllers on the motherboard, along with keyboard, mouse, and other I/O ports.

The mini-LPX board – with i486 CPU, upgradeable cache, and integrated video – is the smallest motherboard solution on the market today that is upgradeable to an OverDrive processor based on Pentium ™ CPU technology.

LPX FORM FACTOR

The Classic R-Series motherboard matches the LPX/LPM standards established by Western Digital. This standard specifies the maximum board size, board mounting locations, connector locations for all external I/O features, and riser card pinout. The Classic R-Series meets all of these capabilities in a very small form-factor motherboard (LPM). Figure 1 illustrates the smaller size of the R-Series board by comparing the layout and mounting hole dimensions with those of the S-Series (LPX). A list of several chassis suppliers supporting the LPX standard is included in Appendix I.

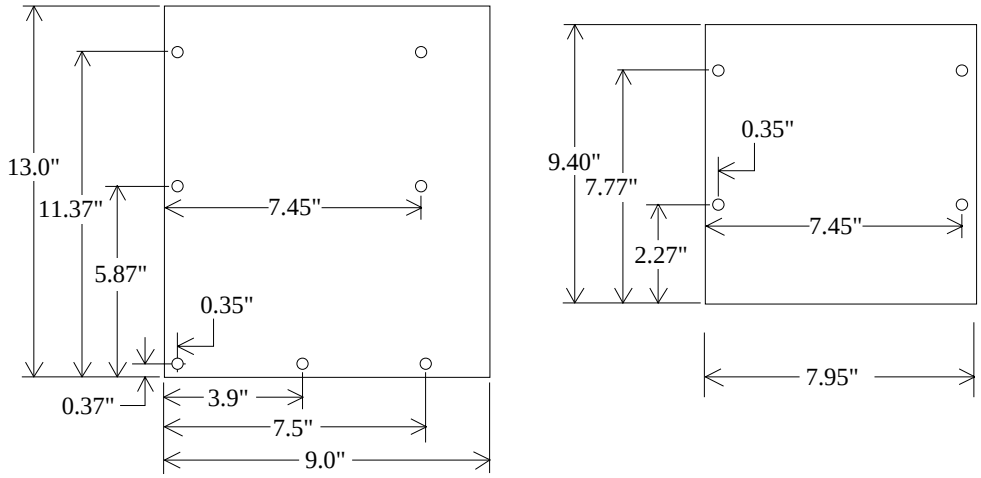
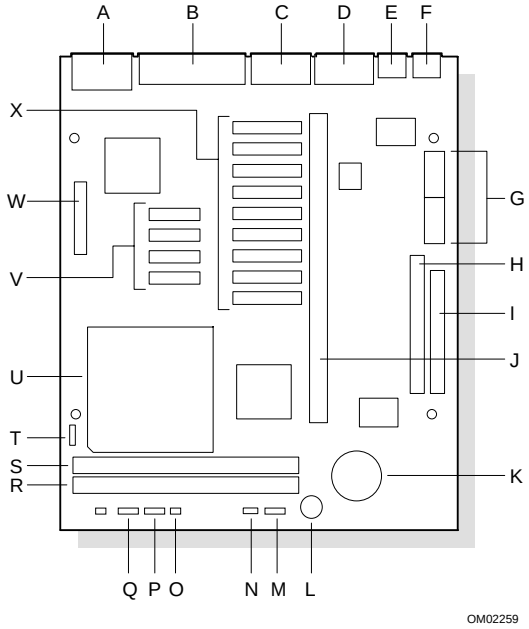


Figure 1. Classic S-Series (LPX) and Classic R-Series (LPM) Motherboard dimensions.

Board Level Features



A – Onboard VGA video connector J1
B – Parallel Port connector J2
C – Serial Port 2 (COM2) connector J3
D – Serial Port 1 (COM1) connector J4
E – Mouse (PS/2 style) connector J5
F – Keyboard (PS/2 style) connector J6
G – Power supply connectors J8, J9
H – IDE hard disk drive header J14
I – Floppy disk drive header J15
J – ISA riser card connector J7
K – + 3V Lithium coin-cell battery and socket J27
L – Piezo speaker
M – External speaker header J33
N – + 12V auxiliary fan header J32 (not used)
O – System Reset header J31 (not used)
P – Keylock/Power LED header J30
Q – Hard drive LED header J29
R – Bank 1 SIMM socket U57
S – Bank 0 SIMM socket U56
T – + 5V auxiliary fan header J26 (not used)
U – CPU Socket U46
V – Video DRAM expansion sockets U22, U25, U28, U34
W – VESA-compliant 8514/A standard feature connector J10
X – Secondary cache SRAM sockets
U10, U14, U15, U20, U23, U26, U29, U35, U40

Figure 2. Classic R-Series system board component locations.

CPU

The Intel486 Classic R-Series has a wide price/performance range to meet a variety of customer needs. Four base CPU options are available:

- an i486 SX running at 25 MHz or 33 MHz;
- an i486 DX at 33 MHz; or
- an i486 DX2 at 66 MHz.

The R-Series supports all of the functionality of the i486. Common features of the CPUs include backward compatibility with the 8086, 80286, and i386™ CPUs, burst mode bus cycles, and an on-chip 8 KB cache. The cache is 4-way set associative, uses a write-through policy, and can be disabled via software.

The i486 DX CPU contains an on-chip numeric coprocessor to increase the speed of floating point operations. This coprocessor is backward code-compatible with i387™ DX and i387 SX math coprocessors and complies with ANSI/IEEE standard 754-1985. The i486 SX does not include the numeric coprocessor. The i486 DX2 incorporates clock-doubling technology developed by Intel to offer the highest CPU performance available today.

PERFORMANCE UPGRADES

The Classic R-Series incorporates a single 238-pin processor socket allowing easy upgrades to CPU performance. All Classic R-Series systems can be upgraded with an OverDrive™ Processor – including future OverDrive Processors based on the Pentium™ architecture. These upgrades will provide significantly higher CPU performance and numerics capability. Systems with an i486SX CPU can improve floating point performance by installing an i487 SX in place of the CPU. When replacing an i486SX CPU with an OverDrive Processor a jumper change is required on the system board. The upgrade process is outlined in Appendices A and B.

SECOND LEVEL CACHE OPTIONS

The Classic R-Series was designed to accept a second level cache using industry-standard SRAM. The VLSI 82C480 chipset includes a direct-mapped, write-back cache controller. The motherboard includes DIP sockets for installation of 64 KB, 128 KB, or 256 KB of cache SRAM. A listing of SRAM vendors and cache installation details are included in Appendices A and B.

SYSTEM MEMORY

The Classic R-Series memory subsystem consists of two 36-bit SIMM sockets, supporting either single- or double-sided SIMMs. The standard system configuration is populated with 4 MB of memory in a single 1 Mb x 36 SIMM. The second SIMM socket can accept a 512 Kb x 36, 1 Mb x 36, 2 Mb x 36, or 4 Mb x 36 SIMM, for totals of 6, 8, 12 or 20 MB. For memory configurations of 16 MB, or greater than 20 MB, the original 1 Mb x 36 SIMM must be removed. Each bank supports 70ns fast page mode SIMMs. While faster DRAM can be installed, there will be no improvement in performance. It is important to match the SIMM socket metal type with the SIMM edge fingers, typically tin, since dissimilar metals can corrode and cause data errors. A change in the system BIOS can enable the use of no-parity SIMMS.

VIDEO SUBSYSTEM

The SVGA video subsystem supports backward software compatibility with MDA, CGA, Hercules Graphics, EGA, and VGA video standards. The Classic R-Series standard configuration includes 512 KB of Video DRAM, allowing resolutions up to 1024 x 768 x 16 colors or 800 x 600 x 256 colors. The video memory can be increased to a total of 1 MB by adding four 256 KB x 4 fast page mode 70 ns DRAMs to the four DIP sockets on the system board to support resolutions of 1280 x 1024 x 16 colors or 1024 x 768 x 256 colors. The Display RAM is paged into 128 KB of RAM located between A0000H and BFFFFH. Video DRAM vendors and installation procedures are listed in Appendix A.

VIDEO CONNECTORS

A standard PS/2 15-pin analog VGA connector is provided on the system back panel. A VESA compliant 8514/A feature connector is located on the baseboard. The 8514/A interface typically is used as a VGA pass-through when an auxiliary video subsystem is installed in one of the expansion slots, such as an 8514/A compatible video card or DVI board.

VIDEO DRIVERS AND UTILITIES

Video drivers and utilities for DOS and Windows 3.1 are shipped with the Classic R-Series system. Included on the diskette are enhanced mode drivers for common MS-DOS software applications such as AutoCAD, AutoDesk, AutoShade, AutoSketch, GEM/3, Lotus 123, Microsoft Word, WordPerfect, WordStar, and Ventura Publisher. These drivers come in a compressed form and are extracted by using an installation utility provided on the diskette. The Video drivers for Windows 3.1 include a utility

called SetRES which allows the user to change the screen resloution, number of colors, and large or small fonts while in Windows. After the new options have been selected, the user can choose to immediately restart Windows or have the new options take place the next time Windows is started. Video drivers for SCO and Interactive UNIX should be obtained from the respective UNIX vendor. Video drivers also are available for downloading from iPAN, the electronic bulletin board service of IntelTechDirect™. This and other support services are listed in Appendix L.

VLSI CHIPSET

82C480 SINGLE CHIP SYSTEM CONTROLLER

- CPU reset control
- CPU internal cache control
- CPU burst mode control
- CPU interface control
- Integrated write-back cache controller with tag comparator
- Page-mode DRAM controller
- Burst line fill control logic
- Data bus conversion
- Parity generation/detection
- AT-BUS direction control
- Clock source for 82C206 and keyboard controller
- Chip select for keyboard controller and RTC
- Speaker control
- NMI logic
- Floating-point coprocessor interface
- Keyboard reset and gate A20 emulation logic
- DMA control
- Interrupt controller
- Real Time Clock
- Timers

82C113A REAL-TIME CLOCK AND KEYBOARD CONTROLLER

The real-time clock (RTC), PS/2-compatible keyboard controller, and battery-backed CMOS RAM are contained within the VLSI 82C113A. This device provides a clock accurate to 12 minutes/year, 14 bytes of CMOS RAM for timekeeping, and 50 bytes of general non-volatile RAM for storage of setup information. All CMOS RAM is reserved for BIOS use. A jumper on the baseboard or a setup option can be used to set system CMOS to its default values. Appendix B lists jumper configurations.

ONBOARD BATTERY

Battery power is provided by a 3V Sanyo lithium coin cell installed in a holder on the motherboard near the front of the chassis. The expected life of the battery is three years. An exhausted battery can be replaced with Sanyo Model CR2032 or similar.

INTEGRATED I/O DEVICES

SMC FDC37C651 (SUPERI/O)

Control for the integrated serial ports, parallel port, floppy drive and IDE hard drive interface is incorporated into a single component, the SMC FDC37C651. This component provides:

- Two NS16450 UARTs (No FIFO support)
- IBM and Centronics compatible bi-directional parallel port controller
- Industry standard floppy controller (1.44 MB floppy support)
- IDE hard disk decode and chip select

SPEAKER

The speaker is integrated onto the Classic R-Series motherboard to reduce unnecessary cabling and improve manufacturability. This piezo device can be enabled or disabled using the Setup utility or can be programmed via port 61H. A connector (J33) also is provided for installing an optional external speaker. The speaker provides error beep code information during the Power-On Self Test if the system cannot use the video interface. The R-Series product guide (Order # 612775-001) contains beep and error code information.

MOUSE AND KEYBOARD INTERFACE

The Classic R-Series has connectors for a PS/2 compatible mouse and keyboard. The 5V line on these connectors is protected with a PolySwitch® circuit which acts much like a fuse except that it re-establishes the connection after an over-current condition is removed. While the PolySwitch eliminates the possibility of having to replace a fuse, care should be taken to turn the system power off before installing or removing a keyboard or mouse.

PHOENIX TECHNOLOGIES SYSTEM BIOS

The Phoenix Technologies BIOS provides ISA compatibility. This BIOS, along with the Cirrus Video BIOS, is incorporated into an Intel 28F001B 1 Mbit FLASH EEPROM device (location U16) to facilitate easy BIOS upgrades from a floppy disk. BIOS upgrades will be available for download from iPAN, the electronic bulletin board service of IntelTechDirect™. The Classic R-Series supports video and system BIOS shadowing, allowing for the execution of any BIOS routines from fast 32-bit onboard DRAM memory instead of the slower 8-bit FLASH device.

FLASH IMPLEMENTATION

The Intel 28F001B 1 Mbit FLASH component is organized as 128 Kbit X 8 (128 KB). The Flash device is divided into five areas, as described in Table 2.

System Address		*FLASH Memory Area*
F0000H	FFFFFH	64 KB Main BIOS
EE000H	EFFFFH	8 KB Boot Block (Not FLASH erasable)
ED000H	EDFFFH	4 KB Flash User area (available)
EC000H	ECFFFH	4 KB Parameter Block (BIOS Only)
E8000H	EBFFFH	CMOS Setup
E0000H	E7FFFH	User available

Table 1. Flash Memory Organization

The FLASH device resides in system memory in two 64 KB segments starting at E0000H, and is distributed in two different organizations, depending on the mode of operation. In *Normal Mode* address line A16 is inverted, switching the E000H and F000H segments so that the BIOS is organized as shown in the system address column above. *Recovery mode* removes the inversion on address line A16, swapping the E000H and F000H segments so that the 8 KB boot block resides at FE000H where the i486 expects the bootstrap loader to exist. This mode is only necessary in the unlikely event that a BIOS upgrade procedure is interrupted, causing the BIOS area to be left in an unusable state. For information on recovering the BIOS in the event of a catastrophic failure, refer to Appendix D.

BIOS IDENTIFIER/REVISION LEVEL

The Classic R-Series BIOS sign-on during POST is 1.00 .01 AC0. As BIOS updates occur, the BIOS revision number will increment by one (i.e. 1.00 01 AC0 increments to 1. 00 02 AC0)

UPGRADE UTILITY

The FLASH upgrade utility (FMUP.EXE; downloadable from iPAN) has three BIOS upgrade options:

- The FLASH BIOS can be updated from a file on a disk;
- The current BIOS code can be copied from the FLASH EEPROM to a disk file as a backup in the event that an upgrade cannot be successfully completed; and
- The BIOS in the FLASH device can be compared with a disk file to ensure the system has the correct BIOS version.

SETUP UTILITY

Classic R-Series incorporates many commonly used system setup features into the FLASH EEPROM. The setup utility is accessible only during the Power-On Self Test by pressing the <F1> key at the 135 POST code. A screen prompt for this key press can be enabled or disabled. The ROM-based setup allows the system configuration to be modified without opening the system for most basic changes. Setup options are detailed in Appendix C.

FLASH USER AREA

Classic R-Series supports a 4 KB programmable Flash User area located at ED00-EDFF. A programmer may use this area to display a customized message or to execute a small program. The Classic R-series BIOS accesses the user area just after completing the POST (Power-On Self-Test) if the setup option is enabled. The flash user area may be updated by running the FMUP.EXE utility, which expects the update files to have a .USR extension. Sample programs and instructions are in the file CLSUSER.ZIP on the iPAN bulletin board.

SECURITY

BIOS PASSWORD

A BIOS password feature provides security during the boot process. A password can be entered using the Setup utility and must be re-entered prior to disk boot each time the system is reset. The password can be changed at the password prompt by entering <old password>/<new password>/<new password><enter>. The password also can be cleared by entering <old password>/<enter>. If the password is forgotten, it can be cleared by turning off the system and setting jumper J20 to 1-2. After the system has finishes the Power-On Self Test, turn the system off and reset jumper J20 to 2-3. This allows the user to again access the password feature, but with the forgotten password cleared.

FLOPPY WRITE-PROTECT JUMPER

A jumper on the baseboard allows the floppy drive(s) to be write-protected to prevent the copying of data to a floppy diskette from any other data storage device. Setting jumper J17 to 2-3 enables the write protect feature.

SETUP ENABLE JUMPER

A jumper on the baseboard controls access to the BIOS Setup utility. By setting jumper J21 to 2-3, the user is prevented from accessing the Setup utility during the Power-On Self Test or at any other time.

KEYBOARD UTILITIES

- CTRL-ALT-DEL: System software reset. This sequence performs a software reset of the system by jumping to the beginning of the BIOS code and running the POST operation, excluding memory tests.

- CTRL-ALT-1 and CTRL-ALT-2: Turbo mode selection. CTRL-ALT-1 sets the system for de-turbo mode (emulation of an 8 Mhz 80286 CPU using wait states) and CTRL-ALT-2 sets the system for turbo mode (its normal operation at 25 MHz or 33MHz). Changing the Turbo mode may be prohibited by an operating system or application software.

System Level Features

A slimline case gives the Classic R-Series a sleek look, while four peripheral bays and three ISA slots offer the expandability required for traditional PC applications. A 145 watt power supply insures that the system can support installation of the maximum number of peripherals and add-in cards. The Classic R-Series has been tested to ensure it meets stringent environmental requirements.

PERIPHERAL BAYS

Four peripheral bays offer ample expandability for add-in devices. The system provides two 5¼" half-height bays, one 3½" one-inch bay, and one 3½" 1.6" bay. Both 5¼" and one of the 3½" bay are accessible from the front panel. The final 3½" hard drive bay is internal. The two 5¼" bays also can accommodate a single 5¼" full-height drive.

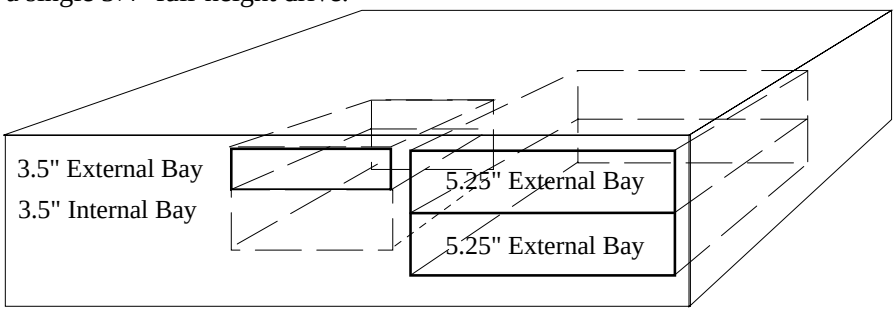


Figure 3. Classic R-Series Peripheral Bays.

EXPANSION SLOTS

The Classic R-Series provides three slots for full-length 16-bit ISA add-in cards. Viewed from the front of the chassis, all three cards are oriented horizontally on the left side of a riser card.

RISER CARD

The Classic R-Series riser card conforms to all LPX standards. The riser has all three 16-bit slots on the same side of the board and an opening along the top of the riser card allows cables to be routed from one side of the chassis to the other without interfering with the top cover. The bottom slot of the riser card is 1.2" above the motherboard to allow a full-length add-in card to comfortably fit above a 1" high SIMM.

FRONT PANEL

The front panel provides access to the system power switch. A power-on LED and a hard disk access LED provide visual system information. The front panel also provides access to three peripheral bays (two 5¼" and one 3½"), as described above.

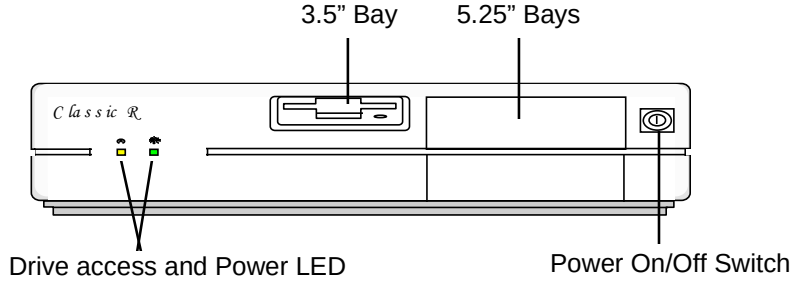


Figure 4. Classic R-Series Front Bezel

BACKPANEL CONNECTIONS

The backpanel provides external access to all of the I/O devices integrated on the Classic R-Series motherboard. Figure 3 shows the backpanel connections.

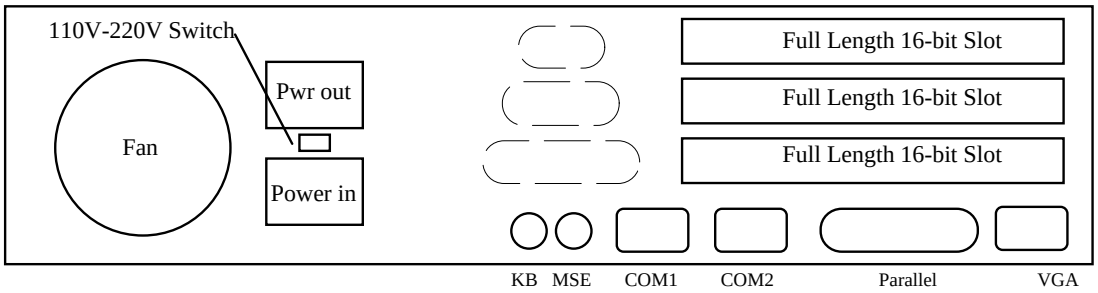


Figure 5. Classic R-Series Backpanel

POWER SUPPLY

A 145 watt switchable power supply (maximum power dissipation: 120 w) is integrated into the Classic R-Series to provide power for onboard resources, add-in cards, and peripherals. The Astec 3420 power supply can be set to operate at either 90-132VAC (5 Amps AC) or 180-264 VAC (3 Amps AC) using a switch on the back of the system. Table 1 listed the current outputs.

DC Voltage	*Max. Continuous Current*	*Peak Current 15 Seconds*	*Minimum Current Load*
+5V	18.0A	18.0	2.5A
-5V	0.3A	0.3A	0A
+12V	4.2A	6.0A	0.5A
-12V	0.3A	0.3A	0A

Table 2. Classic R-Series Current Outputs

Table 2 lists the current used by system resources. This information is preliminary and is provided only as a guide for calculating approximate total system power usage with additional resources added.

Resource	*Typical Power*
R-Series baseboard, 16 MB (8 MB each bank), 256K cache, 1MB Video DRAM	< 15 Watts
Teac 3½" Floppy drive	1.7 Watts

Table 3. Current Use by System Resources (Preliminary)

CHASSIS COLOR

The chassis paint color is Fuller O'Brien 271026C Dusty Beige. The color of the front bezel uses General Electric chip H86204. The bottom and back of the chassis are not painted, but a back panel label shows connector information.

FLOPPY DRIVE

Every Classic R-Series system has an integrated Teac FD-235HF floppy disk drive in the top 3½" bay. This is the same proven floppy disk drive that is used on many other Intel systems.

Performance Benchmarks

BAPCO SUITE

The BAPCo tests were developed in 1992 by a consortium of more than 14 companies (Business Applications Performance Corporation). The SYSmark92 suite is a set of application scripts, data files MS-DOS batch files and executable programs designed to measure overall system performance by realistically using all the computer subsystems. This collection of program scripts is based solely on actual user patterns for a large variety of DOS and Windows applications. The BAPCo scripts are written for use under MS-DOS 5.0 and Windows 3.0. The six areas in the BAPCo suite:

Word Processing	*Database*	*Spreadsheet*	*Desktop Graphics*	*Desktop Publishing*	*S/W Development*
Word 2.0 for Windows	dBase IV v1.5	Lotus 1-2-3 v 3.1+	Harvard Graphics v3.0	PageMaker 4.0 for Windows	Microsoft C v6.0
WordPerfect v5.1	Paradox v3.5	Excel 3.0 for Windows			Borland C++ v2.0
		QuattroPro v3.0			

While the SYSmark92 result is based on popular applications, there are very few Windows or 32-bit applications. The BAPCo test suite is available to anyone, yet it is somewhat difficult to use (over 21 3½" diskettes) and takes up to 10 hours to test a single system configuration. Future enhancements include a test suite based on 32-bit windowing applications with graphical floating point and CPU intensive programs. A standalone 16-bit and 32-bit Networking Benchmark Test also is planned.

System	*Word Proc.*	*Spreadsheet*	*Database*	*Graphics*	*DTP*	*S/W Devel.*	***SysMARK 92***
DX2/66 w/ 256 KB	202.93	204.79	152.16	175.20	236.60	147.42	**189.17**
DX/33 w/256 KB	127.76	130.80	103.33	113.88	153.06	117.32	**123.58**
SX/25 w/256 KB	96.87	96.92	80.26	89.78	117.26	100.28	**94.90**
DX2/66, no cache	158.80	173.61	122.17	157.75	194.85	132.17	**156.71**
DX/33, no cache	112.51	121.14	91.44	108.70	138.46	110.03	**112.22**
SX/25, no cache	88.64	90.87	73.22	86.98	109.15	95.02	**88.36**

Note: Specific configuration information (AUTOEXEC.BAT and CONFIG.SYS files) for the results are available on request.

PC LABORATORIES SUITE, VERSION 7.01

Developed by PC Magazine ZD Labs in late 1992, the version 7.0 suite is considered to be one of the most widely used utilities to measure system performance. PC Magazine consulted CPU component vendors to analyze DOS, Windows and OS/2 16-bit applications to determine the frequency of the instructions executed by the i486 CPU. The ZD Labs utilized new software tools to bring the level of source code and compilers up to date when compared to version 6.0. In March 1993, ZD Labs released the revised version 7.01 and WinBench 3.11 test suites. Specific alterations include memory test script computation formulas, SosMark computation formulas and developments in compilier techniques.

Processor Tests in Release 7.01 have been recompiled to test both real mode and protected mode instructions, focusing on the instruction mix test scripts. The synthetic application scripts are broken into a small instruction mix (1 KB) and a medium instruction mix (48 KB). The small instruction mix will easily fit into the CPU's 8 KB internal cache, while the medium instruction mix utilizes the internal cache and any second level cache. There is no 32-bit instruction mix in this release, but ZD Labs feels confident it will complete a profile of 32-bit application compilation and synthetic 32-bit instruction mix test scripts in a future benchmark (sometime after Windows NT is released).

The **Memory Test** includes five scripts to determine raw memory transfer speed, but only the extended and conventional memory tests are factored when comparing to other computer systems. An average of all extended memory tests and conventional memory tests determines the memory performance result. The extended memory test performs sequential read/write operations in 8-bit, 16-bit and 32-bit blocks in protected mode into every memory location. The conventional memory test performs sequential read/write operations in 8-bit and 16-bit blocks in real mode to every memory location below 640 KB (A0000H).

The **Video Tests** in Release 7.01 are identical to Release 6.0.

PC Labs Suite ver 7.01	*i486DX2/66 w/o cache*	*i486DX2/66 w/ 64 kB*	*i486DX2/66 w/ 128 KB*	*i486DX2/66w/ 256 kB*	*i486DX/33 w/o cache*	*i486DX/33 w/ 64 kB*	*i486DX/33 w/ 128 KB*	*i486DX/33 w/ 256 KB*
Processor Harmonic	12,303.98	16,366.90	15,184.88	16,442.40	8,183.13	9,283.07	8,968.03	9,279.80
Video Harmonic	7,951.99	7,927.11	7,921.99	7,937.62	7,922.01	7,904.17	7,889.92	7,913.80
Memory Harmonic	8,035.06	7,971.45	8,014.31	8,038.69	5,683.03	5,563.14	5,579.51	5,600.23
Disk Harmonic	40.48	39.67	39.43	39.60	38.48	38.35	38.28	38.38
DOSmark Rating	**40.39**	**42.28**	**41.57**	**42.32**	**33.49**	**34.47**	**34.14**	**34.52**

PC Labs Suite ver 7.01	*i486SX/33 w/o cache*	*i486SX/33 w/ 64 kB*	*i486SX/33 w/ 128 KB*	*i486SX/33 w/ 256 kB*	*i486SX/25 w/o cache*	*i486SX/25 w/ 64 kB*	*i486SX/25 w/ 128 KB*	*i486SX/25 w/ 256 KB*
Processor Harmonic	8,070.48	9,116.14	8,852.40	9,116.14	6,272.91	6,848.95	6,662.58	6,879.66
Video Harmonic	7,908.73	7,896.73	7,878.25	7,924.33	7,179.90	7,286.52	7,253.74	7,305.45
Memory Harmonic	5,684.34	5,530.79	5,580.78	5,604.33	4,371.09	4,185.15	4,197.64	4,203.99
Disk Harmonic	38.66	38.44	38.31	38.36	37.95	37.29	37.37	37.52
DOSmark Rating	**33.44**	**34.32**	**34.04**	**34.36**	**29.23**	**29.53**	**29.33**	**29.69**

Each system tested with 8MB system memory, 1MB video DRAM and the WD 2340 hard drive. Tests were conducted by Intel Corp.

PC LABORATORIES SUITE, WINBENCH VERSION 3.11

The **Disk WinMark** is based on testing techniques adapted from PC Magazine's DOS disk test to reflect operation within the Windows 3.1 environment. Each system contained 2 MB of SmartDrive cache. This test determines how effectively the disk processes data files of varying sizes up to 32 MB. This will force disk cache misses. The test simulates large database accesses, large graphic files, and reading/writing small files typically used in word processors and electronic mail. Multi-user, multi-tasking and networking disk access patterns also are simulated.

WINBENCH Version 3.11	*i486DX2/66 w/o cache*	*i486DX2/66 w/ 64 kB*	*i486DX2/66 w/ 128 KB*	*i486DX2/66w/ 256 kB*	*i486DX/33 w/o cache*	*i486DX/33 w/ 64 kB*	*i486DX/33 w/ 128 KB*	*i486DX/33 w/ 256 kB*
640 x 480 x 16								
Graphics WINmark	8.439	9.123	8.786	9.285	5.854	5.959	5.995	6.036
Disk WINmark	48.042	49.048	48.962	49.929	44.303	45.114	45.057	45.238
640 x 480 x 256								
Graphics WINmark	8.769	9.752	9.617	10.048	5.808	6.165	6.169	6.188
Disk WINmark	47.550	49.182	49.025	49.384	44.565	45.083	45.014	45.338
800 x 600 x 256								
Graphics WINmark	8.525	9.247	9.126	9.337	5.598	6.025	5.933	6.008
Disk WINmark	46.491	49.244	49.102	49.338	44.275	45.539	45.171	45.992
1024 x 768 x 256								
Graphics WINmark	6.286	7.113	7.003	7.200	4.903	5.056	5.079	5.153
Disk WINmark	47.658	48.877	49.042	49.782	44.193	45.233	45.096	45.327
1280 x 1024 x 16								
Graphics WINmark	5.643	6.012	5.877	6.027	4.241	4.339	4.332	4.331
Disk WINmark	47.760	48.967	48.589	49.342	44.286	44.934	45.149	45.808

WINBENCH Version 3.11	*i486SX/33 w/o cache*	*i486SX/33 w/ 64 kB*	*i486SX/33 w/ 128 KB*	*i486SX/33 w/ 256 kB*	*i486SX/25 w/o cache*	*i486SX/25 w/ 64 kB*	*i486SX/25 w/ 128 KB*	*i486SX/25 w/ 256 kB*
640 x 480 x 16								
Graphics WINmark	5.714	6.048	5.947	6.005	4.508	4.611	4.632	4.643
Disk WINmark	44.261	45.077	45.062	44.936	42.108	43.103	43.106	43.104
640 x 480 x 256								
Graphics WINmark	5.810	6.142	6.104	6.216	4.466	4.709	4.626	4.702
Disk WINmark	44.433	45.300	45.094	45.573	42.410	43.167	42.595	43.148
800 x 600 x 256								
Graphics WINmark	5.745	5.989	5.835	6.067	4.375	4.514	4.473	4.581
Disk WINmark	44.353	45.102	45.106	45.996	42295	43.098	42.721	42.749
1024 x 768 x 256								
Graphics WINmark	4.970	5.099	5.123	5.195	3.997	4.107	4.059	4.145
Disk WINmark	44.301	45.081	45.166	45.320	42.239	42.991	43.093	43.156
1280 x 1024 x 16								
Graphics WINmark	4.235	4.342	4.304	4.313	3.326	3.415	3.429	3.455
Disk WINmark	44.261	45.209	44.280	45.923	42.088	43.152	43.079	43.069

Each system tested with 8MB system memory, 1MB video DRAM and the WD 2340 hard drive. Tests conducted by Intel Corp.

DHRYSTONE SUITE

Dhrystone versions 1.1 and 2.1 are measurements of processor speed when executing a 'typical' program. The typical program was designed by taking a mix of C instructions and measuring statistics on a large number of real applications. The typical program was written using these statistics. In 1988, after an evaluation of the Dhrystone in achieving its original goals, version 2.1 was released. Although expected to be close, Dhrystone numbers for version 2.1 are lower than those in version 1.1. Version 2.1 is intended to provided a more realistic benchmark by defeating some compiler optimizations that were becoming common, but not representative of those applied to real programs. The benchmark allows the use of internal registers (r) or no registers (nr) when executing and is dependent on the 32-bit compiler used. Dhrystone tests only fixed-point calculations and is weighted towards the CPU/Cache/Memory subsystem and serves as a compiler optimization intensive benchmark which tests virtually no I/O transfers across the EISA/ISA bus. The benchmark is a small program which easily fits into a 64 KB cache. While the Dhrystone suite is a good indication of performance for a single processor system, it is a somewhat poor indication of overall throughput. The VAX MIPS number is a derivative of the Dhrystone version 1.1 benchmark, obtained by dividing by 1757 (the Dhrystone result on a VAX 11/780).

SCO ODT 2.0 Intel C v5.1.1 beta	*Dhry1.1nr4*	*Dhry1.1r4*	*Dhry2.1nr 4*	*Dhry2.1r4*
DX2/66 / 256 kB	91,743	92,592	65,789.5	65,789.5
DX/33 / 256 kB	55,555	55,865	39,525.7	39,370.1

Each system tested with 16 MB (80ns) system memory, Adpatec 1542B SCSI controller and Maxtor 535S MB Hard Drive.

MIPS COMPUTATION

The VAX MIPS (million of instructions per second) is a measure used in conjunction with the Dhrystone benchmark. Different packages contain MIPS rating benchmarks which can give very contrary results. The MIPS rating depends on the CPU frequency, instruction mix executed, system response and compiler. To calculate the MIPS rating, vendors compile and execute the Dhrystone program to determine how many times it can be executed in one second. The result is divided by 1757 (the rating for a VAX 11/780 executing the same Dhrystone program). The same method can be used to determine a MIPS rating using Dhrystone Version 2.1 by dividing by 1657.

SCO ODT 2.0 Intel C V5.1.1 (beta)	*DX2/66 w/ 256 KB cache*	*DX/33 w/ 256KB cache*
MIPS w/ Dhry 1.1	56.35	31.62
MIPS w/ Dhry 2.1	39.70	23.85

Each system tested with 16 MB (80ns) system memory, Adpatec 1542 SCSI controller and Maxtor 535S MB Hard Drive.
SCO ODT 2.0 is based on X-Windows Version 11 Release 4.0 and Open Software Foundation's Motif Release 1.1

SPECMARK SUITE

SPECmark was developed by the Standard Performance Evaluation Corporation in 1989 in a cooperative effort by various companies to introduce a benchmark involving UNIX applications. The ten SPEC 1.2b programs perform CPU intensive, fixed integer arithmetic, floating point arithmetic and some disk I/O tests in a technical environment. SPEC publishes a comprehensive comparison of tested computer systems to document the configuration, compiler, operating system, and benchmark results. The suite executes each test twice for accuracy on a 32-bit tested system. Many times the SPECmark tests are divided into three separate areas to distinguish between CPU-intensive system performance (SPECint), floating point performance (SPECfp), and overall system performance (SPECmark). While the SPECmark89 suite established itself as the standard for UNIX testing, in some cases it is not the best predictor for commercial applications in a business environment.

Recently, SPEC released a new suite of 32-bit UNIX benchmarks to replace the SPEC 1.2b tests. The Cint92 suite is a collection of six compute-intensive integer benchmarks intended to stress the CPU/memory subsystem, cache subsystem, and software compiler. The result is the geometric mean of the six integer benchmarks called SPECint92.

SCO ODT 2.0 Intel 'C' v5.1.1 (beta)	*espresso*	*li*	*eqntott*	*compress*	*sc*	*gcc*	***SPECint92***
DX2/66 w/256 cache	28.7	38.2	32.4	17.9	46.9	27.6	**30.6**
DX/33 w/256 cache	16.3	23.0	18.4	11.4	28.5	19.3	**18.7**

Each system tested with 16 MB (80ns) system memory, an Adpatec 1542B SCSI controller and a Maxtor 535S MB Hard Drive.
SCO ODT 2.0 is based on X-Windows version 11 Release 4.0 and the Open Software Foundation's Motif Release 1.1

Appendix A – User-Installable Upgrades

PERFORMANCE UPGRADES

There are several CPU upgrade paths. If you have an i486 SX processor, you can upgrade it with an Intel487 SX, an i486 DX processor or an OverDrive Processor (through Pentium processor-based OverDrive components, when available). Systems with an i486 DX can be upgraded with the OverDrive components. Upgrading requires removing the current CPU from the 238-pin socket, U46, on the system board. The upgrade processor is plugged into the socket and jumpers are reconfigured at locations U18, U19, and U22 thru U25. The jumpers at U18 and U19 adjust the clock speed and the jumpers at U22 thru U25 select the CPU type. Intel487 and OverDrive components are available from Intel's Personal Computer Enhancement Division. For the location of the nearest Intel dealer, phone 1 (800) 538-3373.

SYSTEM MEMORY

Table A-1 shows the total system memory based on the listed combinations of SIMMs in the two banks. Rows in boldface indicate possible configurations using the 4 MB SIMM supplied in Bank 0.

Bank 0 - SIMM Type(Amount)	*Bank 1 - SIMM Type(Amount)*	*Total System Memory*
512Kb X 36 (2MB)	Empty	2MB
512Kb X 36 (2MB)	512Kb X 36 (2MB)	4MB
512Kb X 36 (2MB)	1Mb X 36 (4MB)	6MB
512Kb X 36 (2MB)	2Mb X 36 (8MB)	10MB
512Kb X 36 (2MB)	4Mb X 36 (16MB)	18MB
1Mb X 36 (4MB)	**Empty**	**4MB**
1Mb X 36 (4MB)	**512Kb X 36 (2MB)**	**6MB**
1Mb X 36 (4MB)	**1Mb X 36 (4MB)**	**8MB**
1Mb X 36 (4MB)	**2Mb X 36 (8MB)**	**12MB**
1Mb X 36 (4MB)	**4Mb X 36 (16MB)**	**20MB**
2Mb X 36 (8MB)	Empty	8MB
2Mb X 36 (8MB)	512Kb X 36 (2MB)	10MB
2Mb X 36 (8MB)	1Mb X 36 (4MB)	12MB
2Mb X 36 (8MB)	2Mb X 36 (8MB)	16MB
2Mb X 36 (8MB)	4Mb X 36 (16MB)	24MB
4Mb X 36 (16MB)	Empty	16MB
4Mb X 36 (16MB)	512Kb X 36 (2MB)	18MB
4Mb X 36 (16MB)	1Mb X 36 (4MB)	20MB
4Mb X 36 (16MB)	2Mb X 36 (8MB)	24MB
4Mb X 36 (16MB)	4Mb X 36 (16MB)	32MB

Table A-1. Possible SIMM Memory Combinations. (Note: A system BIOS change can enable the use of no-parity SIMMs.)

CACHE SRAM

The Classic R-Series can be upgraded with a second level cache by adding industry-standard SRAM components to DIP sockets on the baseboard. Possible combinations are listed in Table A-2. The design requires 15 ns data SRAM and 12 ns tag bit SRAM. Appendix B lists required jumper settings.

	SRAM Size		
Cache Size	*Bank 0 U23,U26,U29,U35*	*Bank 1 U10,U14,U15,U20*	*Tag Bit U40*
64 K	(4) 8Kb x 8	(4) 8Kb x 8	(1) 8Kb x 8
128K	(4) 32Kb x 8	none	(1) 32Kb x 8
256K	(4) 32Kb x 8	(4) 32Kb x 8	(1) 32Kb x 8

Table A-2. Possible Second Level Cache Combinations.

Table A-3 lists the part numbers for 64K, 128K, or 256K cache components from several vendors.

Device Type	*Motorola*	*Cypress*	*IDT*	*Samsung*
8 Kb x 8, 15 ns	MCM6264CP15	CY7C185-15PC	7164S15TP	KM68685BP-15
8 Kb x 8, 12 ns	N/A	N/A	7164S12TP	N/A
32 Kb x 8, 15 ns	MCM6206CP15	CY7C199-15PC	71256S15TP	KM68257BP-20
32 Kb x 8, 12 ns	N/A	N/A	71256S12TP	N/A

Table A-3. Sampling of Cache Component Vendors.

VIDEO DRAM

The Classic R-Series systems can be upgraded to 1 MB of video DRAM by installing four 70 ns 256 K x 4 page mode DIP DRAM components into socket locations U22, U25, U28, and U34. Table A-4 lists several vendors and their part numbers.

Vendor	*Part Number*
Texas Instruments	TMS44C256-70N
Siemens	HYB514256B-70
Toshiba	TC514256AP-70
NEC	uPD424256

Table A-4. Sampling of Video DRAM Component Vendors

Appendix B – Jumpers

(* denotes default setting; jumpers can be located using a label on top of the 5¼" drive bay)

J11 - CACHE SIZE SELECTION

7	5	3	1
8	6	4	2

	Jumper Block				
Cache Size	*1-2*	*3-4*	*5-6*	*7-8*	*SRAM Required*
0 K	Do Not Care				No SRAM Installed
64 K	Out	Out	Out	Out	8K x 8 (both banks)
128K	In	Out	In	Out	32K x 8 (bank 0)
256K*	In	In	Out	In	32K x 8 (both banks)

Table B-1. Jumper J11 Options

J12 - FLASH WRITE

1-2* Enable +12V to FLASH (Erasable) 2-3 Disable +12V to FLASH

J13 - FLASH BOOT BLOCK (RECOVERY MODE ENABLE)

1-2* Boot from standard BIOS 2-3 Boot from Boot Block (recovery mode)

J16 - ONBOARD VIDEO

1-2* Enable onboard video 2-3 Disable onboard video

J17 - FLOPPY WRITE PROTECT

1-2 Floppy write protected 2-3* Floppy writable

J18, J19 - SET CPU SPEED

Note: Use J18-J19 only for a speed change when installing an upgrade processor. Changing the speed of the main processor can damage the component.

	J18	*J19*
25 MHz	1-2	1-2
33 MHz	1-2	2-3

Table B-2. Jumper J18 and Jumper J19 Options.

J20 - PASSWORD JUMPER

1-2 Disable and clear password 2-3* Enable password

J21 - CMOS SETUP PROTECTION

1-2* Allow user to enter Setup 2-3 Prevent user from entering Setup

J22, J23, J24, J25 - MAIN CPU SELECTION (FACTORY DEFAULTS - DO NOT CHANGE)

CPU TYPE	*J22*	*J23*	*J24*	*J25*
i486SX	1-2	2-3	2-3	2-3
i486DX or DX2	2-3	1-2	1-2	2-3
i487SX or Pentium based OverDrive CPU	2-3	1-2	2-3	1-2

Table B-3. Factory Default Main CPU Selection Jumpers.

J28 - CLEAR CMOS JUMPER

1-2* Installed (Don't clear CMOS) 1-2 Removed (Clear CMOS upon power-up)

Appendix C – Setup Options

SETUP PAGE 1

Choice	*Default Settings*	*Comments*
System Time	Current time	Can also change from DOS
System Date	Current date	Can also change from DOS
Onboard Diskette	Enabled	
Diskette A	3 1/2-inch, 1.44 MB	
Diskette B	Not Installed	
Onboard IDE	Disabled	
Hard Disk 1	Not Installed	
Hard Disk 2	Not Installed	
User Definable Drives	2 and 3	
POST Memory Test Prompt	Disabled	
POST Setup Prompt	Disabled	
Scan FLASH User Area	Disabled	
Speaker	Enabled	
Onboard Mouse	Enabled	
Keyboard	Installed	
Numlock on at Boot	No	
Password	Not Installed	

SETUP PAGE 2

Base Memory	Set by system	Display only; cannot be changed.
Extended Memory	Set by system	Display only; cannot be changed.
Base Memory Above 512K	Enabled	
Speaker	Enabled	
Onboard Mouse	Enabled	
Parallel Port	Base Address 378H: Compatible/IRQ7	
Parallel Port Interrupt	Enabled	Disable for polled mode operation
Serial Port 1	Enabled	
Serial Port 2	Enabled	
Video Type	VGA/EGA	
Video Horizontal Refresh	31.5 kHz	
640 x 480 (VGA) Vert. Refresh	60 Hz	Display only; based on Horizontal
800 x 600 Vert. Refresh	Not Available	Display only; based on Horizontal
1024 x 768 Vert. Refresh	Not Available	Display only; based on Horizontal
1280 x 1024 Vert. Refresh	Not Available	Display only; based on Horizontal
VGA Mode Refresh Rate	60 Hz	Options are 60Hz or 72 Hz
Onboard Video BIOS Mapping	To E0000H	

SETUP PAGE 3

Choice	*CMOS Clear Default*	*Comments*
CPU Speed	Fast	
Cache	Enabled	Optimum performance
Refresh Mode	Synchronous	
Shadow C0000H to C3FFFH	Disabled	
Shadow C4000H to C7FFFH	Disabled	
Shadow C8000H to CBFFFH	Disabled	
Shadow CC000H to CFFFFH	Disabled	
Shadow D0000H to D3FFFH	Disabled	
Shadow D4000H to D7FFFH	Disabled	
Shadow D8000H to DBFFFH	Disabled	
Shadow DC000H to DFFFFH	Disabled	

Appendix D – BIOS Recovery

The Classic R-Series incorporates a Phoenix Technologies system BIOS on a FLASH component. FLASH BIOS allows easy upgrades without the need to replace an EPROM. The upgrade utility fits on a floppy diskette and provides the capability to save, verify, and update the system BIOS. The upgrade utility can be run from a hard drive or a network drive, but no memory managers can be installed during upgrades.

The latest upgrade utility and BIOS code are available in the *public* section of the iPAN bulletin board.

USING THE UPGRADE UTILITY

If the utility is obtained from iPAN, UNZIP the archive and copy the files to a bootable MS-DOS 3.3, 4.01, 5.0, or 6.0 bootable diskette. Reboot the system with the upgrade diskette in the bootable floppy drive and follow the directions in the easy to use menu-driven program.

RECOVERY MODE

In the unlikely event that a FLASH upgrade is interrupted catastrophically, it is possible the BIOS may be left in an unusable state. Recovering from this condition requires the following steps:

1. Change jumper J13 to position 2-3.
2. Install the bootable upgrade diskette into drive A:
3. Reboot the system.
4. Because of the small amount of code available in the non-erasable boot block area, no video is available to direct the procedure. The procedure can be monitored by listening to the speaker and looking at the floppy drive LED. When the system beeps and the floppy drive LED is lit, the system is copying the recovery code into the FLASH device. As soon as the drive LED goes off, the system can be turned off.
5. Reset jumper J13 to position 1-2.
6. Leave the upgrade floppy in drive A: and turn the system on.
7. Continue with the original upgrade.

Appendix E – Memory Map

Address (Decimal)	*Address (hex)*	*Size*	*Description*
16384K-32768K	1000000-2000000	16384K	Extended Memory
16256K-16383K	FE0000-FFFFFF	128K	System & Video BIOS Copy
1024K-16255K	100000-FDFFFF	15232K	Extended Memory
960K-1023K	F0000-FFFFF	64K	Phoenix System BIOS
952K-959K	EE000-EFFFF	8K	FLASH Boot Block (Available as himem)
948K-951K	ED000-EDFFF	4K	User FLASH Area (Available as himem if no user info is here)
928K-947K	E8000-ECFFF	20K	Setup Pgm (disable via setup pre-boot; then avail as himem)
896K-927K	E0000-E7FFF	32K	Cirrus Video BIOS
800K-895K	C8000-DFFFF	96K	Available Hi DOS Memory(open to the ISA bus)
768K-799K	C000-C7FFF	32K	Optional VGA BIOS (enable via setup; if disabled, open to ISA bus)
736K-767K	B8000-BFFFF	32K	VGA Display Memory (not available to ISA bus)
704K-735K	B0000-B7FFF	32K	VGA/Mono Display Mem (HI mem w/ QEMM)(not available to bus)
640K-703K	A0000-AFFFF	64K	VGA Display Memory (not available to the ISA bus)
639K	9FC00-9FFFF	1K	Extended BIOS Data (moveable by QEMM,386MAX)
512K-638K	80000-9FBFF	127K	Extended conventional
0K-511K	00000-7FFFF	512K	Conventional

Table E-1. Classic R-Series Memory Map

Appendix F – System Interrupts

IRQ	*System Resource*
NMI	Parity Error
0	Reserved, Interval Timer
1	Reserved, Keyboard buffer full
2	Reserved, Cascade interrupt from slave PIC
3	On-board Serial Port 2
4	On-board Serial Port 1
5	User available or Parallel port
6	On-board Floppy controller
7	On-board Parallel Port
8	Real Time Clock
9	User available
10	User available
11	User available
12	On-board Mouse Port if enabled, otherwise available to user
13	Reserved, Math coprocessor
14	IDE if enabled
15	User available

Appendix G – Connectors

VIDEO PORT (J1)

Pin	*Signal Name*
1	Red
2	Green
3	Blue
4	No Connect
5	Ground

Pin	*Signal Name*
6	Ground
7	Ground
8	Ground
9	No Connect
10	Ground

Pin	*Signal Name*
11	No Connect
12	No Connect
13	Horizontal Sync
14	Vertical Sync
15	No Connect

PARALLEL PORT (J2)

Pin	*Signal Name*	*Direction*
1	Strobe*	Output
2	Data Bit 0	Bi-Directional
3	Data Bit 1	Bi-Directional
4	Data Bit 2	Bi-Directional
5	Data Bit 3	Bi-Directional
6	Data Bit 4	Bi-Directional
7	Data Bit 5	Bi-Directional
8	Data Bit 6	Bi-Directional
9	Data Bit 7	Bi-Directional

Pin	*Signal Name*	*Direction*
10	ACK*	Input
11	BUSY	Input
12	PE (Paper End)	Input
13	SLCT	Input
14	Auto Feed XT	Output
15	ERROR*	Input
16	INIT*	Output
17	SLCT IN	Output
18 - 25	Ground	

SERIAL PORTS (J3=COM1, J4=COM2)

1	DCD* (Data Carrier Detect)
2	SIN (Serial Input)
3	SOUT (Serial Output)

4	DTR* (Data Terminal Ready)
5	Ground
6	DSR* (Data Set Ready)

7	RTS* (Request to Send)
8	CTS* (Clear to Send)
9	RI* (Ring Indcator)

MOUSE/KEYBOARD PORTS (J5=MOUSE, J6=KEYBOARD)

1	Data
2	No Connect
3	Ground

4	Vcc
5	Clock
6	No Connect

POWER CONNECTOR (J8 & J9)

J8 Pin	*Name*	*Function*
1	PWRGD	Power Good
2	+5 V	+ 5 volts
3	+12 V	+ 12 volts
4	-12 V	- 12 volts
5	GND	Ground
6	GND	Ground

J9 Pin	*Name*	*Function*
1	GND	Ground
2	GND	Ground
3	-5 V	- 5 volts
4	+5 V	+ 5 volts
5	+5 V	+ 5 volts
6	+5 V	+ 5 volts

VESA CONNECTOR (J10)

Pin(s)	*Signal Name*
1,3,5,15,17,19,21,26	Ground
2,4,6,8,10,12,14,16	Data 0:7
7	Data Enable
9	Sync Enable

Pin(s)	*Signal Name*
11	PCLK Enable
18	PCLK
20	BLANK*
13,23	Vcc

IDE CONNECTOR (J17)

Pin	*Signal Name*
1	Reset IDE
2	Ground
3	Host Data 7
4	Host Data 8
5	Host Data 6
6	Host Data 9
7	Host Data 5
8	Host Data 10
9	Host Data 4
10	Host Data 11
11	Host Data 3
12	Host Data 12
13	Host Data 2

Pin	*Signal Name*
14	Host Data 13
15	Host Data 1
16	Host Data 14
17	Host Data 0
18	Host Data 15
19	Ground
20	Key
21	IOCHRDY
22	Ground
23	I/O Write
24	Ground
25	I/O Read
26	Ground

27	IOCHRDY
28	BALE
29	Reserved
30	Ground
31	IRQ14
32	IOCS16
33	Addr 1
34	Ground
35	Addr 0
36	Addr 2
37	Chip Select 0
38	Chip Select 1
39	Activity
40	Ground

FLOPPY CONNECTOR (J18)

Pin	*Signal Name*
2	Reduced Write*
4	Reserved
6	Reserved
8	Index
10	Motor Enable A
12	Drive Select B
14	Drive Select A
16	Motor Enable B
18	DIR
20	STEP

22	Write Data
24	Write Gate
26	Track 00
28	Write Protect
30	Read Data
32	Sid 1 Select
34	Diskette Change
1,3,7,9,11,13,15,17, 19,21,23,25,27,29, 31,33	Ground
5	key

AUXILLARY 5V FAN CONNECTOR (J26)

1	+5V
2	Key

3	Ground
4	Ground

HARD DRIVE LED CONNECTOR (J29)

1	LED_HD +5V
2	HD ACTIVE

3	Key
4	Ground

KEYLOCK/POWER LED CONNECTOR (J30)

Pin	*Signal Name*
1	LED_PWR +5V
2	Key
3	Ground
4	KEYLOCK
5	Ground

RESET CONNECTOR (J31)

1	RESET
2	Ground

AUXILLARY 12V FAN CONNECTOR (J32)

Pin	*Signal Name*
1	Ground
2	+12V
3	Ground

EXTERNAL SPEAKER CONNECTOR (J33)

1	SPK3
2	Key
3	SPK4
4	+5V

Appendix H – Video Modes

Setup Option/Horiz. Freq. (kHz)	*Monitor Examples*	*Horiz. (kHz)*	*Vert. (Hz)*	*Resolutions*
31.5	IBM 8512, 8513, 8503	31.5	60	640x480
31.5 & 35.5	IBM 8514, 8515	31.5 35.5	60 43.5 - interlaced	640x480 1024x768
31.5 - 35.2	NEC 2A	31.5 35.2	60 56 43.5 - interlaced	640x480 800x600
31.5 - 35.5	NEC II	31.5 35.2 35.5	60 56 43.5 - interlaced	640x480 800x600 1024x768
31.5 - 37.8	NEC 3D	31.5 37.8 37.8	60 or 72 60 43.5 - interlaced	640x480 800x600 1024x768
31.5 - 48	Sony CPD-1304, NEC 3FGx, Nanao 9065S, 9070U	31.5 48.0 48.0 48.0	60 or 72 72 60 Non-interlaced 43.5 - interlaced	640x480 800x600 1024x768 1280x1024
31.5 - 56	NEC 4D, 4FG, Nanao T240i	31.5 48.0 56.0 48.0	60 or 72 72 70 Non-interlaced 43.5 - interlaced	640x480 800x600 1024x768 1280x1024
31.5 - 64	NEC 5D, 5FG, 6FG Nanao T550i, T560i, T560i, T660i, F550i F750i	31.5 48.0 58.3 48.0	60 or 72 72 72 Non-interlaced 43.5 - interlaced	640x480 800x600 1024x768 1280x1024

Appendix I – LPX Chassis Suppliers

Axxion Group Corporation
11 B. Leigh Fisher
El Paso, TX 79906
(915) 772-0088

Olsen Metal Products
1001 Crossroads Boulevard
Seguin, TX 78155
(512) 379-2799

Enlight Corporation, USA
345 Cloverleaf Drive, Unit 2B
Baldwin Park, CA 91706
(818) 369-4709

Appendix J – Regulatory Standards

Parameter	*Condition*	*Specification*
Temperature		
	Non-Operating	-40°C to +70°C
	Operating	+10°C to +35°C
Humidity		
	Non-Operating	92% Relative Humidity max. @ 36°C
	Operating, no hard disk	80% Relative Humidity max. @ 36°C
	Packaged Product	92% Relative Humidity max. @ 40°C
Altitude		
	Non-Operating	50,000 feet (15,240 meters)
	Operating	10,000 feet (3048 meters)
ESD		
	1.0kV	No Errors
	2.5kV	No Errors
	5.0kV	5% Soft Errors, 0% Hard Errors, No physical damage
	7.5kV	10% Soft Errors, 0% Hard Errors, No physical damage
	10.0kV	25% Soft Errors, 5% Hard Errors, No physical damage
	12.5kV	50% Soft, 10% Hard, No physical damage
	15.0kV	100% Soft, 25% Hard, No physical damage
	25.0kV	100% Soft, 100% Hard, No physical damage
Shock	Non-Operating	30.0G, 11ms, 1/2 sine
Acoustical Noise	1 meter, peripherals idle	Less than 40 dB max.

SAFETY CERTIFICATIONS

Underwriters Laboratories (U.S.A.)	UL1950, 1st Edition 1991	Listed
CSA - (Canada)	CSA C22.2 No.950-M89	Certified
TUV Rheinland of N.A. - (Germany)	EN 60 950-1988 + A1/A2 IEC 950 (2nd Edition 1991)	Certified
NEMKO (Norway; includes SEMKO, Sweden, SETI, & Finland certifications)	EN 60 950-1988 + A1/A2	Certified

EMI CERTIFICATIONS

Federal Communications Commission - (U.S.A.)	CFR47, Pts 2 and 15 Class B	Certified
BZT - (Germany)	CISPR 22, Class B	Reg. to Vfg. 243/1991
Dept. of Communications - (Canada)	CRC c.1374, Class B	Compliant
VCCI - (Japan)	Class 2 I.T.E.	Compliant
VDE (Germany)	VDE 0871 Class B	Tested/Compliant
NEMKO (Norway; includes SEMKO, Sweden, SETI, & Finland certifications)	EN 55 022, Class B	Certified

Appendix K – Reliability Data

This Mean-Time-Between-Failures (MTBF) data is calculated from predicted data @ 35C.

Classic R-Series baseboard (i486 SX/25, 4 MB)	96,511 hours
Power Supply (Astec SA145-3420)	100,000 hours
Floppy drive (Teac FD-235HF-4240)	30,000 hours
Classic R-Series system (i486 SX/25, 4 MB, floppy)	47,072 hours

Appendix L – Customer Support

The Classic R-Series is backed by Intel's industry-leading support groups in the OEM Products and Services Division (OPSD), including IntelTechDirect™. OPSD can support many of your network integration and service needs, including worldwide integration and system repair services. IntelTechDirect provides the following 4 major services:

IPAN (INTEL PRODUCT ASSISTANCE NETWORK)

An electronic Bulletin board with current product information, demo software and more...

- Available worldwide through direct-dial
- Modem speeds up to 14.4k baud with standard software
- FLASH BIOS upgrade files
- Modem set at no parity, 8 data bits, 1 stop bit.

IPUB (INTEL PRODUCT UPDATE BULLETIN)

- Monthly Product updates available 24 hours a day from iPAN
- Official notification of engineering changes and technical data
- Easy information retrieval using Windows Help file format
- Intel platform system, board, and BIOS revision histories
- Hardware and software compatibility notes
- Documentation updates, spare parts and order information

IPALS (INTEL PHONE ACTION LINE SUPPORT)

A direct telephone support line backed by highly qualified and well trained technical personnel.

- Toll-free access to Intel support engineers for problem resolution
- Responses within 24 hours Monday-Friday
- Expert assistance geared to the secial needs of OEMs and VARs

FAXBACK™

- Product descriptions and technical data sent to any fax machine from a touchtone phone
- Information on End-of-Life products
- Available worldwide through direct dial at 916-356-3105

For information about IntelTechDirect please contact your local Intel Sales Representative.

Appendix M – Physical Specifications

SYSTEM

Height	11.0 cm	4.3" (with feet installed)
Width	43.7 cm	17.2"
Depth	41.1 cm	16.2"
Weight	9.1 kg	20.0 lbs (floppy installed)

BOARD

Length	23.876 cm	9.40"
Width	20.193 cm	7.95"
Height	3.05 cm	1.2" (SIMM installed)

Appendix N – Product Codes

SYSTEMS

R486SX254F	i486 SX-25 system, 4MB, 3½" floppy drive
R486SX334F	i486 SX-33 system, 4MB, 3½" floppy drive
R486DX334F	i486 DX-33 system, 4MB, 3½" floppy drive
R486D2664F	i486 DX2-66 system, 4MB, 3½" floppy drive

BOARDS

BR486SX254F	i486 SX-25 board, 4MB
BR486SX334F	i486 SX-33 board, 4MB
BR486DX334F	i486 DX-33 board, 4MB
BR486D2664F	i486 DX2-66 board, 4MB

(All boards are bulk shipped in quantities of 10)

ACCESSORIES

Accessory kit includes:

- One power cord
- One product guide (Order # 612775-001)
- One IDE cable
- Video Driver Diskette

DOCUMENTATION

The Classic-R system ships with a product guide, but also will have an online electronic Technical Reference manual using a Windows Help engine interface. The electronic Technical Reference manual will be available via the iPAN bulletin board system.