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Prime Computer

THE COMPUTER HISTORY MUSEUM



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PRIME Computers

	Prime 100	Prime 200	Prime 300
Word Length		16 bits	
Memory Type		MOS	
Memory Cycle Time	1 microsec.	750 nanosec	600 nanosec
Memory Capacity	32K words	64K words	256K words
Memory Increments		8K words	
Addressing	direct, indirect and indexed in sector and relative modes		
Number of Instructions	109	127	164
Hardware Registers		32	
DMA Channels		eight standard	
I/O Word Size		16 bits	
Priority Interrupt Levels		64	
Max. I/O Data Rate	500K words/sec.	1M words/sec.	1.25M words/sec.
I/O Bus Capacity		64 devices	
Basic Chassis Size		10½"H x 19" W x 20" D	
Operating Temp.		10°-50°C	
Operating Humidity		20%-95%	
AC Power	117 VAC or 230 VAC, 50 or 60 Hz Models		
Hardware Mul/Div		✓	S
Double Precision Arith.		✓	S
Hardware Floating Point			✓
Serial Async. Interface		S	S
Byte Parity		S	S
Microverification		✓	S
Power Monitor	✓	✓	✓
Real Time Clock	✓	✓	✓
Automatic Prog Load	✓	✓	S
Hardware Memory Protect			S
Virtual Memory			S
Unimplemented Inst. Trap	S	S	S
Illegal Inst. Trap	S	S	S
DMC/DMT Capability	✓	✓	S
Conditional Jump Instructions			S
Stack Procedure Instructions			S
Restricted Execution Mode			S

✓ available as standard or optional feature, depending on processor type

S available as standard feature

PRIME Peripherals

Teletypes	Model 33 ASR: Keyboard/printer, 8 channel reader/punch, 10 char./sec. Model 33 KSR: Keyboard/printer, 10 char./sec. Model 35 ASR: Keyboard/printer, 8 channel reader/punch, 10 char./sec.
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High Speed Paper Tape Ready Punch	Available as reader/punch combination or reader only. Reads 8 channel fanfold tape at 200 cps, punches 8 channel fanfold tape at 75 cps.
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Card Reader	Serial, photo-electric reader operates at up to 150 cpm.
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Line Printer	Serial, dot matrix printer prints up to 200 lpm, 132 columns, 64 alphanumeric characters.
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Fixed-Head Disks	Head per track disks provide storage capacities of 140,800 or 281,600 16-bit words, a transfer rate of 3.8 microseconds per word and an average access time of 8.7 milliseconds. Two drives may be attached to the same controller.
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Moving-Head Disks	Two compact cartridge disk drives are available, one with a single removable cartridge stores 1.5M words, the other with both a removable cartridge and fixed disk stores either 3.0M words in a basic version or 12M words in a double-track, double-density version. The 1.5M and 3.0M word disks transfer data at a rate of 6.4 microseconds per word with an average seek time of 35 milliseconds. The 12.0M word disk has a 3.2 microsecond/word transfer rate. Any combination of up to four drives may be attached to the same controller.
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Magnetic Tape Transports	Industry-compatible, 7- and 9-track drives read and write data stored 556 or 800 bits per inch, at a speed of 45 inches per second. Any mix of up to four drives may be attached to the same controller.
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General Purpose Interface	Interfacing non-standard devices, building specialized data acquisition systems and handling other custom I/O functions can be easily accomplished with PRIME's versatile general purpose interface board. It combines a foundation of prefabricated and pretested I/O bus logic with a universal pin connector grid for building the desired controller logic.
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Prime Computer, Inc., 17 Strathmore Road, Natick, Mass. 01760. (617) 655-6999.

PRIME Software

Disk Operating System – Virtual Memory

DOS-VM enables up to 15 users to time-share the computer's resources.

Each time-sharing user has a memory segment of up to 64K words in a system with as little as 32K words of real memory (or as much as 256K words).

Additional real memory is not mandatory to expand the number of tasks or users handled by the system. However, system response can be enhanced at the user's option simply by adding one or more 8K memory increments.

Real Time Operating System – Virtual Memory

RTOS-VM foreground tasks can reside in memory or be paged in from a disk.

DOS can run as a background task under control of RTOS-VM.

RTOS-VM protects tasks against unwanted alterations by other tasks.

Disk Operating System

System file management features include multiple directories and multiple volume control and file access methods.

The entire Disk Operating System is written in FORTRAN.

DOS functions as a batch operating system, providing automatic job and data stream routing by storing command sequences on a disk.

Disk files are constructed with forward and backward pointers to prevent accidental loss of one file from snowballing into multiple losses.

Files are addressed by name rather than absolute location.

DOS supports compressed ASCII files.

Real Time Operating System

RTOS is a compact, multiprogramming operating system that schedules processor, main memory and disk memory resources for optimum control of application programs executed in a real-time environment.

RTOS is available in memory-only and memory/disk configurations.

RTOS provides interrupt handling, multiprogram scheduling, simultaneous input/output and general supervisory functions.

DOS can run under control of RTOS, and, conversely, real-time systems can be developed under DOS.

RTOS is supported by a complete set of utility, debugging, and I/O device test programs.

Stand-alone Systems

Stand-alone systems are supported with exactly the same language translators, I/O controllers, and loaders as larger operating system configurations.

FORTRAN IV

The compiler executes in one pass and produces highly optimized code.

The source language is ANSI extended FORTRAN plus other extensions derived from the proposed Instrument Society of America FORTRAN for control applications.

Source language extensions include embedded logical functions such as AND, OR, NOT and XOR; run-time trace; octal constants; and an extended support library.

Macro Assembler

A major improvement in symbolic language processor design, PRIME's macro assembler offers a simple, yet powerful means of generating application-oriented macro statements.

The assembler features pseudo-ops for assembly, listing, and loader control; symbol and data definition; storage allocation; program linking; and conditional assembly.

Desectorizing Link-loader

Relocatable or absolute program modules from a PRIME language translator may be loaded, linked and bound with the link-loader.

Cross-sector references are automatically desectorized and literals, links and temporaries are optimized.

The link-loader saves the loader table for fast symbolic debugging.

DOS can be used to save and restore partial program loads.

Edit and Debug Resources

A full-context editor provides line-by-line and character-by-character editing and automatic execution of string buffers for multiple changes of the same text throughout a program.

A bulk media converter provides editing and transcription resources for handling large volumes of data.

Debugging aids include an interactive trace routine for examining, patching, tracing, etc.

Input Output Control System

The IOCS is a system of stream control routines and device drivers which provide device independence for user programs and centralized I/O control for all systems software.

A unique IOCS feature is the provision for source file editing and merging.

Support Library

The support library includes I/O conversion and driver packages, and standard and extended math functions.

The FORTRAN support library provides formatted I/O, encode and decode statement translators, and list processing functions.

The extended I/O driver library provides both interrupt driven and queued request device handling.

Verification and Maintenance

Thorough verification routines are provided for all PRIME central processors. Special processor features, including non-functional tests and micro diagnostics greatly enhance the fault diagnosis capabilities of the various test and maintenance routines.

PRIME Data Acquisition Products

Analog to Digital Conversion Subsystem

• 11 bits plus sign gives accuracy $\pm 0.1\% \pm \frac{1}{2}$ LSB • 50kHz throughput • differential input for high noise rejection • choice of DMA or programmed I/O • dual channel DMA gives 50kHz random channel select • four programming ranges increase accuracy over $\pm 10V$ dynamic range • autorange for flexibility and simplified programming • sample and hold with external sync. provides 20 nsec. aperture • three data formats: left justified, auto shift, floating point • FORTRAN driver callable under RTOS • flexible scan modes: sequential, random, internal/external sync. • up to 64 channels (in 16 channel increments) on a single board • current input signal conditioning • card edge or industrial screw terminal connection.

Digital Input Subsystem

• photo-diode signal isolation • 64 inputs in four groups of 16-each for simplified program control (any group can be contact sense or contact interrupt • two programmable input counters for pulse/count accumulation and contact/voltage sensing • vectored contact interrupt and counter overflow • maskable priority interrupts • FORTRAN driver callable under RTOS • 5 volt operation • signal conditioning available for 12, 24, 48V • 5 msec bounce filters available • card edge or industrial screw terminal connection.

Digital Output Subsystem

• photo-diode signal isolation • 64 TTL outputs in four groups of 16-each • programmable output counter develops pulses of varying number, frequency and width • signal conditioning for pulse and driver output • FORTRAN driver callable under RTOS • card edge or industrial screw terminal connection.

Digital to Analog Conversion Subsystem

• 10 bit (including sign) resolution • $\pm 10V$ F.S. output at 10ma • isolated differential output • electrostatic and electromagnetic shielding • modular configuration: two per board, expandable to four • FORTRAN driver callable under RTOS • card edge or industrial screw terminal connection.

PRIME Communication Products

SPECIFICATIONS	Asynchronous Multi-Line Controller AMLC		Multiple Synchron- ous Line Controller MSLC	Multiple Auto- Call Interface MACI
	Switched network	direct connect		
Interfaces with	103/202 data sets with full controls	direct connected teletypes, peripherals, other devices; 103/202 data sets with limited controls	201/203 data sets	801 auto call units
No. of lines	type 5002=8 lines type 5004=16 lines	type 5052=8 lines type 5054=16 lines	type 5201=1 line type 5202=2 lines type 5203=3 lines type 5204=4 lines	type 5402=4 lines
Transmission type	full or half duplex			NA
External interface	RS232-C/CCITT V24		RS232-C	RS366
Speeds — Program selectable on a per-line basis (PS/L)	8:4 fixed @110, 134.5, 300 + 1200; 1 spec'd by user; 3 jumpered from 75, 150, 600, 1800, 2400, 4800, 9600 + 19,200.		a function of the data set clock, up to 20,000 baud	NA
Character size (PS/L)	5, 6, 7, or 8 bits (exclusive of parity bit)			NA
Stop bits (PS/L)	1 or 2		NA	NA
Parity (PS/L)	odd, even, or no parity			NA
Echo (PS/L)	on a character basis			NA
Data set controls per line	data terminal ready, request to send, XMT reverse channel/ originate mode	one only	request to send, speed select, new sync, carrier detect, data terminal ready	NA
Data set status per line	data set ready, clear to send, carrier detect, rev. chnl. carrier det, receive reverse channel, ring indicator	one only	data set ready, clear to send, carrier detect, ring indicator	NA
Optional features	NA	NA	type 5240: CRC/LRC type 5241: BISYNC type 5243: down line ldr	NA
Cables	type 5035 (1:1)	type 5031 (1:4)	type 5231 (1:1)	type 5431 (1:2)

The Prime Computer User Plan.

The Plan

This booklet describes a totally new way to buy, use, and upgrade computer systems. It's called the Prime Computer User Plan, or just simply "The Plan". The purpose of the plan is to show you what computing resources are available from Prime, how those resources can be combined into systems that fit your performance needs as well as your budget, and what Prime has done to help you protect your computer system investment as applications change.

As you read through the plan, we hope three things will become apparent. First, the general concepts and specific details of the plan are unique. For instance, only Prime offers a guaranteed two year trade-in plan, complete upward and downward program compatibility among all

computers in the line, and a low cost computer maintenance plan called "Air Spare". Second, the features in the plan are responsive to user needs. You can put together a system that is a better cost/performance fit to your application, with fewer restrictions and trade-offs, than ever before possible. Third, the plan is based on sound, state-of-the-art technology. Flexibility is built into Prime computers, from the underlying software-first design philosophy to the extensive use of microprogrammed logic in the central processors, peripheral device controllers and input/output interfaces.

Protecting your investment when you buy Prime Computers

When you buy a Prime computer system you can be sure that you are getting the best system for your application at the best price. You are sure because you put it together exactly the way you wanted it. Not too much of one capability nor too little of another. No arbitrary configuration restrictions to prevent you from getting a just-right price/performance balance. No gimmicky take-them-as-they-are systems to force you into paying for features you don't want or for more than you need. In fact, at Prime we feel you should have as much freedom to leave things out of a system as you do to put them in. Which is really the key to everything we've put into this plan — freedom of choice.

1. Select processor features and capabilities

Standard Processor Features	
Prime 300 Central Processor (1 board)	• Virtual Memory — automatic paging, mapped address translation to 256K words, restricted execution mode, and memory protect • Stack Procedure Instructions • Micro Verification Routines** • Hardware Multiply/Divide and Double Precision Arithmetic* • DMC/DMT Capability* • Automatic Program Load From Input Devices (PTR, TTY, CR, MT, Disk)*
Prime 200 Central Processor (1 board)	• Memory Byte Parity • Processor Byte Parity • Full Addressing Modes — direct, indirect, and indexed in both sector and relative modes
Prime 100 Central Processor (1 board)	• Virtual Instruction Package (VIP) — automatic trapping of unimplemented instructions and substitution of functionally equivalent software subroutines • 8-Channel Programmable DMA • 4-Channel Full Duplex Asynchronous Serial Interface • Multi-level Vectored Priority Interrupt System
* Optionally available on Prime 100 and 200	
**Optionally available on Prime 200	

Freedom to choose from interchangeable components: basic and enhanced central processors, memories, chassis, power supplies, peripherals and interfaces. Freedom to choose from three distinct purchase plans, each with a different balance of services and discount schedules to satisfy varying user needs. And, as you will see in subsequent sections of this booklet, freedom to change your mind — and your computer system — without risking the investment you have already made in hardware and software and without paying a premium for the ability to change.

Before describing what choices are available to you when putting together a Prime computer system, a few words on how it is that Prime can offer such a wide range of alternatives with no strings attached.

It comes from the way we translated our understanding of what most users want in a small computer into a product design philosophy and then into the products themselves. We did it by developing the software first to produce a unified and compatible set of programming resources

2. Add enhancements

	Prime 300	Prime 200	Prime 100
• Power Monitor (Battery Back-Up for MOS Memory)	✓	✓	✓
• Automatic Program Loaders	Std.	✓	✓
• DMC/DMT Capability	Std.	✓	✓
• Hardware Multiply/Divide (integer)	Std.	✓	✓
• Micro Verification Routines	Std.	✓	N/A
• Floating Point Arithmetic Hardware*	✓	✓	N/A
• Writable Control Store*	✓	N/A	N/A
✓ = Optional Feature N/A = Not Available			
*These features are located on the Extended Control Store Board which requires one board space in the chassis.			

that could be used in all hardware configurations without restrictions. By designing completely flexible hardware through the extensive use of microprogrammed logic, not only in all the central processors which are 100% microprogrammed, but in peripheral device controllers and input/output interfaces as well. By building complete logic functions such as central processors, controllers, interfaces and power supplies on single plug-in circuit boards so they can be easily installed, maintained, and changed. By developing a uniform electromechanical packaging system that permits any combination of circuit boards to be plugged into any chassis without resorting to jumper cables, board extenders, extra power supplies or restrictive configuration rules. In summary, the complete system — hardware, software, everything — was designed and built to be as adaptable to your needs as present technology could make it.

Processor performances comparison

	Prime 300	Prime 200	Prime 100
Memory Cycle Time (nanoseconds)	600 or 750	750	1000
Max. Addressability (16-bit words)	256K	64K	64K
Number of Instructions (std/opt)	145/31	117/37	112/9
Execution Times:			
Add from Memory	1.56 μ sec.	1.85 μ sec.	2.44 μ sec.
Skip on Condition	1.80-2.00 μ sec.	2.04-2.32 μ sec.	2.84-3.20 μ sec.
Shift A Right	.92 + .2N μ sec.	1.08 + 2.4N μ sec.	1.4 + 3.6N μ sec.
Complement A	1.12 μ sec.	1.36 μ sec.	1.76 μ sec.
Max I/O Rate (words/sec.)	1,250,000	1,084,956	694,444

How to put a system together

The summary charts below show the basic combinations of central processors, memories and chassis, and the processor features, controllers and interfaces that can be added to those configurations. Complete configuration details, including I/O controllers, peripheral devices and system packaging will be found in the *Prime Computer Configurator*. With this information and a current *Prime Computer Price List* you can put together the system you want at the price you want. Try it.

3. Select peripherals

Terminals:	ASR33, KSR33, ASR35, CRT Display
Paper Tape:	200 cps Reader, 75 cps Punch
Card:	300 cpm Reader, 400 cpm/100-285 cpm Reader/Punch
Mass Storage:	Fixed Head Disk — 128K and 256K word Moving Head Disk — 1.5M, 3.0M and 6.0M word Diskette — 138K word Magnetic Tape — Industry Compatible 800 bpi, 45 ips, 7 or 9 track
Printers:	Character Printer — 165 cps, 132 columns Line Printer — 300 lpm, 132 columns

4. Specify peripheral controllers and system interfaces

Number of Boards	Controllers and Interfaces	Clocks	Terminals	Paper Tape	Punched Cards	Printers	Disks	Mag Tape	Communications	Acquisition/Control	General Purpose	Multi Processor
1	System Option Controller: includes Real Time Clock (60 Hz or programmable); Watchdog Timer, Four-Port, Single-Line Serial Controller (synchronous and/or asynchronous); Paper Tape Reader Controller or BPIOC (16-bit, HDX), Paper Tape Punch Controller or BPIOC (16-bit, HDX). BPIOC = Buffered Parallel I/O Channel											
1	Controller for Card Reader (300 cpm), Card Reader/Punch (400 cpm/100-285 cpm), Line Printer (300 lpm, 132 col.)											
1	Disk Controller for up to two Fixed Head Disks (128K and 256K word capacities available) and four Moving Head Disks (1.5M, 3.0M, and 6.0M word capacities available.)											
1	Diskette Controller (138K words/diskette)											
1	Mag Tape Controller for one to four 7 and/or 9 track, 800 bpi, 45 ips transports											
1	Asynchronous Multi-Line Controller for direct connected devices and data sets with limited control (EIA and/or 20 ma), 8 or 16 lines											
2	Asynchronous Multi-Line Controller with full 103/202 data set controls, 8 or 16 lines											
1	Synchronous Multi-Line Controller, 201/203 data sets, up to four lines											
1	Multiple Auto Call Interface, 801, 4 lines											
1	Analog Input System, 16-64 channels											
1	Digital Input System, 64 lines, +2 pulse counters											
1	Digital Output System, 64 lines, +2 pulse trains											
1	Analog Output System, 2 to 6 channels											
1	General Purpose Interface Board for custom logic											
1*	Inter Processor Controller (*per system)											

5. Determine minimum hardware configuration for software development

Prime Operating System	Language	Fortran IV	Basic (Extended)	Macro-assembler	Micro-assembler
Multi-user disk operating system (DOS/VM)		Prime 300 System with 32K-256K Memory, Disk, System Terminal, and 1-15 User Terminals			
Single user disk operating system (DOS)		Any Prime System with Disk or Diskette, System Terminal, and following minimum main memory:			
		16K	16K	16K	32K
RTOS foreground/DOS background		Prime 300 System with Disk or Diskette, System Terminal, and following minimum main memory:			
		32K	32K	32K	48K
Stand alone		Any Prime Processor with Teletype and following minimum main memory			
		16K	16K	16K	32K

for software execution

Operating System	Processor	System Terminal	System Residence Main Mem.	Disk/Diskette	Minimum Main Memory	Operating Environment
Stand Alone	Any	Opt	✓		4K	User-Supplied Executive
RTOS	Any	Opt	✓		4K	Memory-Only
	Any	Opt		✓	8K	Direct Access to 128 Word Segments
	Any	One TTY or CRT		✓	16K	DOS File Compatibility
	Prime 300	One TTY or CRT		✓	32K	RTOS Foreground/DOS Background
DOS	Any	One TTY or CRT		✓	16K	Single User
	Prime 300	One TTY or CRT		✓	32K	Multi-User

6. Select chassis

CPU + Memory Boards	Memory Size (K = 1024 words)	Prime 100	Prime 200	Prime 300	CPU + Memory Boards	Memory Size	Prime 300	Central Processor
		1 μsec	750 nsec	750 nsec			600 nsec	Memory Cycle Time
		no	yes	yes			yes	Memory Byte Parity
		5 10 17	5 10 17	5 10 17			5 10 17	Chassis Size (Boards)
2	4K	✓	✓	✓	2	8K	✓	✓ indicates available configuration which can be specified by type number created as follows: P X YYY Z-NN- AC Power blank = 117 vac, 60 Hz A = 230 vac, 50 Hz Chassis Size 05 = 5 Board 10 = 10 Board 17 = 17 Board Memory Speed A = 1 μsec B = 750 nsec C = 600 nsec Memory Size 004 = 4K words 008 = 8K words . 256 = 256K words Central Processor 1 = PRIME 100 2 = PRIME 200 3 = PRIME 300
2	8	✓	✓	✓	3	16	✓	
2	16	✓	✓	✓	4	24	✓	
2	32	✓	✓	✓	5	32	✓	
3	48	✓	✓	✓	6	40	✓	
3	64	✓	✓	✓	7	48	✓	
4	96				8	56	✓	
5	128				9	64	✓	
6	160							
7	192							
8	224							
9	256							

How to buy it

Prime offers a choice of three distinct purchase plans. The following table outlines the significant differences among them to help you decide which one provides the balance of discounts and services that best fits your needs.

Features	Purchase Plans		
	Full Service	Limited Service	OEM
Warranty	90 days	45 days	30 days
OEM qualification	No	No	Yes
Training	2 wks/system	2 wks	2 wks
Software & documentation	1 set/system	1 set	1 set
Milestones required	None	None	20% 1st 6 months 50% 1st 9 months 100% 1st 12 months
Unearned discount bill-back	None	None	Unearned discount billed back +1% interest
Forfeiture of discount	No	No	Yes (payment due in 30 days)
Retroactive discount applied to increased volume	No	Yes	No
Typical discount schedules:			
Units			
1	0%	0%	10%
5	6%	10%	19%
10	11%	15%	26%
Labor rates for on-site warranty services	\$20/hour	\$30/hour	\$30/hour
Shipping charges for equipment returned to factory for service under warranty	No charge	Billable	Billable

Protecting your investment when you use Prime Computers

The software investment

As you saw on the preceding pages, Prime computer systems are designed to go together with as few restrictions as possible. But this freedom of choice to "fine-tune" system resources to fit an application is only the first step in maximizing the return on your investment in Prime computers. The next step comes when you use them. That's when you'll discover first-hand the value of Prime's software-first design philosophy. By specifying all of the system software first and then building the hardware to run it, Prime is able to offer a new level of software operating efficiency and functional capability.

For example, it permitted the creation of one unified software system for all computers in the line. By standardizing all software elements, programs can literally be developed on one computer and run on that or any other in the line without modification. File compatibility among all software systems assures a simple and manageable transition from program development to program execution. Prime's use of FORTRAN as a systems programming language greatly simplifies generation, maintenance and modification of major software components such as the Disk Operating System. Finally, using the software as a blueprint to define the microprogrammed hardware resulted in numerous features such as a unique group of "logicize" instructions, virtual instruction packages, memory reference instructions, and FORTRAN use of floating point arithmetic hardware; all of which make the software easier to use and the total system more productive.

In short, Prime planned a totally integrated and compatible system of hardware and software resources that automatically preserve the investment you make in programming and software development. We guarantee it.

The Prime software compatibility guarantee

You can write real-time and time-independent programs on any Prime processor, in any language, under Disk Operating System control, or as stand alone programs, using a common set of support packages. You can then execute the developed programs on the same or any other Prime processor under Disk or Real Time Operating System control, or as stand alone programs — without modification. Furthermore, the Prime 300 supports a multiuser, virtual memory version of the Disk Operating System (DOS/VM) and a foreground background version of the Real Time Operating System (RTOS/VM).

Downward software compatibility without program modification assumes the availability of equivalent memory and peripheral configurations and no program timing dependency on the larger processor's operating cycle. Virtual instruction packages are provided on the smaller processors to trap all unimplemented instructions (except those related to virtual memory management) and automatically execute software subroutine equivalents. A summary description of all currently available Prime software, hardware configuration requirements for system software, and operating characteristics is provided in *The Prime Computer Software Guide*.

Choose Any Processor	Choose Any Development System	Choose From Support Packages	Choose Any Language	Choose Any Operating System
100 200 300	DOS Stand-Alone	File Systems Library Utilities IOCS	Macro Assembler FORTRAN BASIC	DOS RTOS Stand-Alone

The hardware investment

All the software flexibility and compatibility in the world won't do you much good on a computer that isn't working right. Naturally PRIME goes a long way toward making sure that the equipment you receive is as reliable and bug-free as we can make it. Components, subassemblies and systems are baked, bumped, bounced and battered in as rigorous a testing and quality assurance program as you'll find anywhere. Use of MSI and LSI integrated circuits throughout the computer (processors, MOS memories, controllers and power supplies) plus the packaging of major functions on individual 15" x 17" circuit boards maximizes reliability by minimizing the total number of discrete components and subsystem interconnections. And a rugged yet simple mechanical package allows the computer to be installed in a wide range of operating environments without special cooling, stiffening, or other modification.

These are some of the things Prime does to make sure that malfunctions occur as infrequently as possible. Here's what we've done to help you when one does. Prime provides one of the most comprehensive arrays of error detection and fault location features available in the industry. Every byte of data on every data path in the processor, on the backplane, in every register, in every memory location and device controller is checked for parity on the Prime 200 and 300. Microverification routines can test the validity of an entire

central processor in less than 130 microseconds. Loop-back test features permit peripheral devices to be logically isolated from their controllers so that each may be tested separately. With these resources at your disposal, you can pinpoint with a very high degree of confidence the occurrence and the location of a system malfunction.

To help keep your system up and running, Prime provides a wide range of service options. You can buy a comprehensive on-call service contract for a monthly charge. Depending on the size of the system covered by such a contract, you can qualify for a substantial service discount as shown in the following table. You can obtain on-site service on a non-contract, time and materials basis. You can have equipment repaired at one of Prime's regional service centers. Or you can take advantage of a new concept in computer maintenance — Prime's Air Spare Plan.

The Air Spare Plan

The Air Spare Plan is designed to keep your system running and provide factory repair of a faulty circuit board at the lowest possible price. Here's how it works. Features like microverification and loop-back remove a lot of the mystique from determining what caused a failure. You don't need a lot of special test equipment or a lot of time to isolate a faulty circuit board. Once you determine where the problem is, unplug the board and ship it back to the factory. Prime will air express a temporary backup board to you from the nearest regional service center so you can keep the system running while repairs are being made. As soon as possible we'll ship back your repaired board in exchange for the temporary loaner board. Total cost: \$200 plus freight and insurance.

System Price Increments	Monthly Service Charge (as a % of System List Price)
First \$10,000	1%
Second \$10,000	.9%
Third \$10,000	.8%
Fourth \$10,000	.7%
Fifth \$10,000 and up	.6%

Protecting your investment when you upgrade and expand your Prime Computer System

The Prime computer you start with doesn't have to be the one you live with forever. It's designed to be changed. Easily, efficiently, and above all economically. So if an application outgrows the system you first put together to handle it, you can simply change those features (and only those features) that are standing in the way of better performance. As you'll see below, Prime has provided some very practical and useful ways to help you get the new system features you need while at the same time protecting the investment you've already made in hardware and software.

To start with, Prime provides the kinds of expansion and upgrade features you should expect from any user-oriented computer manufacturer. What you might not have expected though, is how easy we've made it for you to add new features to your present system. In most cases, putting new computing resources to work involves little more than plugging them in.

The *Prime Computer Configurator* summarizes the peripherals, input/output interfaces and processor enhancements that are presently available. For example, you can expand mass storage capacity by adding any mix of four moving head disks (1.5-, 3-, and 6-million word capacities

are available) and two fixed head disks (128,000, and/or 256,000 words per disk) to a single controller. Similarly, any combination of up to four 7- or 9-track magnetic tape transports can be attached to a single controller. Other peripherals can also be added: punched card and paper tape equipment, printers, and terminals — all complete with necessary software.

You can add processor performance options like single- and double-precision floating point arithmetic, convenience features like automatic program loading from disk and magnetic tape and system integrity features such as microverification firmware. You can expand system capacity by plugging in modular line increments for data acquisition and communication controllers. And you can plug in more main memory (a Prime 300 can handle up to 262,144 words of MOS memory).

But what happens when instead of adding more features to the same basic computer, what you really need is a more powerful computer? Perhaps you need a central processor with more speed, a fuller instruction set or performance features not appropriate to smaller members of the line? Or maybe it's a larger chassis to handle additional interfaces, along with more power supply capacity to handle the load? For situations like these Prime has a simple but unique solution: the two year guaranteed trade-in plan.

The two-year guaranteed trade-in plan

At any time within two years of initial installation (or shipment from our plant if you handle installation directly) you have the option of trading in a system's central processor, processor options, main memory, chassis, power supply or various combinations of these units, and purchasing larger or more powerful equipment at guaranteed upgrade prices. A complete schedule of all upgrade prices is included in the *Prime Computer Price List*. The new equipment replaces the original equipment without electrical or mechanical modification. And all existing software will run on the new configuration, also without modification. Here's an example of how the plan works.

To upgrade from a Prime 200 to a 300 central processor all you have to do is unplug the original processor board and trade it in for a new one. Just by swapping processor boards you can add virtual memory capability, memory addressing to 262,144 words, hardware multiply/divide as well as nearly 40 additional instructions, expanded direct memory access features supporting a maximum data transfer rate of 1.25M words/sec., automatic program loaders, and microverification firmware. Nothing else need be changed. The new processor will work with the existing chassis, power supply, peripheral devices and controllers, interfaces, even the original Prime 200's main memory. And it will run all existing software without modification as well as support virtual memory versions of Prime's Disk and Real Time Operating Systems.

Memory upgrade

[illegible]

You can also elect to equip the new processor with various optional features, such as single and double precision floating point arithmetic, writeable control store and automatic program load from disk or magnetic tape. The prices of these and other options for the Prime 300 are listed in the *Prime Computer Price List*.

The guaranteed trade-in can be applied to upgrading from a PRIME 100 to a 200 or 300 central process, or from a 200 to a 300. The notes below summarize the prerequisites and conditions involved when exercising this feature of the plan.

1. The user may trade-in the original processor board or elect to keep it as a spare for a small additional charge.
2. The price to upgrade to a Prime 200 is for a Prime 200 CPU with byte parity, 8 channel programmable DMA system, async serial communications interface and multi-level vectored priority interrupt system.
3. The price to upgrade to a Prime 300 is for a Prime 300 CPU with virtual memory capability, byte parity, 8-channel programmable DMA/DMC/DMT system, extended direct addressing to 256K words, hardware multiply/divide, double precision arithmetic, automatic program load from all peripherals, async serial communications interface, microverification routines, and multi-level vectored priority interrupt system.

From 1 microsec to 600 nanosec									
K=1,024 words									
From	To	8K	16K	24K	32K	40K	48K	56K	64K
4K									
8K									
16K									
32K									
48K									
64K									

4. A 50% trade-in credit is allowed on the original purchase price of the following options physically located on the central processor board, when the new processor includes the same features.
 - DMC/DMT capability
 - hardware multiply/divide and double precision arithmetic
 - microverification firmware
5. The following options are physically independent of the processor board and can therefore be retained for use with a new processor.
 - battery backup for MOS memory
 - automatic program loaders
 - single- and double-precision floating point arithmetic
6. The Prime 100's main memory must be upgraded at the same time the processor is upgraded to assure proper implementation of the parity checking system in Prime 200 and 300 systems.

Memory upgrade

Memory modules may be traded in for modules of the same capacity and higher speed, larger capacity and same speed, or both larger capacity and higher speed. The following tables show the various upgrades possible. These tables are duplicated in the *Prime Computer Configurator*, complete with type numbers for all upgrade memories. Prices for all allowable memory upgrades are included in the *Prime Computer Price List*.

Chassis and power supply upgrade

Additional board capacity can be obtained by trading in the original chassis for a larger one. The trade in involves replacing the circuit board cage, etched back plane, integral cooling fans and keylock. The original power supply module and programmer's console are retained and reused with the new chassis. If the new chassis configuration requires additional power, the original power supply may be traded in for a larger one as indicated below.

From 750 nanosec. to 600 nanosec.									
K=1,024 words									
From	To	8K	16K	24K	32K	40K	48K	56K	64K
4K									
8K									
16K									
32K									
48K									
64K									
96K									
128K									
160K									
192K									
224K									
256K									

CHASSIS UPGRADE			
From	To	10 Board	17 Board
5 Board		✓	✓
10 Board			✓

POWER SUPPLY UPGRADE		
From	To	100 amp
44 amp		✓
50 amp		✓

A final word about The "Plan"

What you have just read is as much a statement about PRIME computers as it is about the company itself. We did a lot of planning so you can plan on using our products with as few restrictions (or costly surprises) as possible. We developed a technology plan and a business plan that work together to help you plan a powerful, reliable, easy-to-use system, at a better total system price than ever before possible. We invite you to put the plan to work. Use the enclosed reply card to obtain additional planning aids, including the latest editions of the PRIME Computer Configurator, and PRIME Software Guide.

As its name suggests, the Plan was created for you — the computer user. It should make it easier for you to select, use and upgrade computer systems. It should save you time and money. And the Plan, together with its companion documents — the Prime Computer Configurator,

Software Guide and Price List, should spell out exactly what products we offer and what you have to do to use them.

How can we make it better?

Obviously there is room for improvement in the method of presentation as well as the products and services presented. We would like to know what you think about the Plan, and especially what you would like to see added, changed or eliminated. Please give us your comments either on the enclosed reply card or by writing directly to Robert C. Baron, President, Prime Computer, Inc., 23 Strathmore Road, Natick, Mass. 01760.

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