Convergent

NGEN Series 386i

- **Powerful 32-bit microcomputer supporting configurations of 1 to 32 users**
- **Intel 80386 microprocessor operating at 20 MHz**
- **Optional 20 MHz Intel 80387 numeric coprocessor**
- **Memory expansion from 4 to 24 MB**
- **Multiple I/O bus architecture for maximum data throughput**
- **Configurable with 140 MB to 2.2 GB of mass storage**
- **Base system support for two DMA-driven RS-232-C ports, DMA-driven bidirectional parallel port, and RS-485 local area network (LAN)**
- **Software-compatible with Convergent's NGEN family of workstations**
- **Server for NGEN workstations and PC compatibles via high-speed RS-485 LAN**
- **Supports both CTOS/VM and multiple MS-DOS environments**
- **Host communications facilities include BSC 3270 terminal emulator, BSC 2780/3780, and SNA (interactive and RJE)**
- **Data management facilities include ISAM, Sort/Merge, and an interactive Forms package**
- **Programming languages include C, FORTRAN, Pascal, BASIC, COBOL, and Assembler**

The Convergent Technologies® high-performance NGEN® Series 386i™ processor is designed as a professional workstation for demanding personal productivity applications and as a departmental computer serving data processing and LAN environments. Using the full 32-bit potential of the 20-MHz Intel® 80386 microprocessor and a unique cache design, the Series 386i provides the highest level of microcomputer performance available from a desktop professional workstation.

The Series 386i is the second generation of NGEN systems using the 80386 processor. In addition to performance enhancements provided by the cache, Convergent™ has incorporated several features that eliminate traditional system bottlenecks, including multiple input/output (I/O) bus structures, multiple DMA channels (with two full-duplex communications channels), high-capacity fast access disk drives, and support for a 20-MHz 80387 coprocessor.

Added up, the Series 386i provides a complete performance package to the data processing and office automation user. In fact, the combination of a high-performance processor design, up to 10 MB/sec I/O transfer rates, fast access drives, and high-performance communications support allows the Series 386i to effectively challenge typical minicomputer solutions at a price below comparatively configured IBM® PS/2™ systems.

The Series 386i makes use of the Convergent virtual machine operating system, CTOS/VM™, to provide a multitasking protected mode environment that supports a mixture of both CTOS™ and the more restricted MS-DOS® environments. In addition to the comprehensive offerings of CTOS-based programs, CTOS/VM supports multiple MS-DOS environments – a task even the IBM OS/2™ cannot perform.

CTOS/VM allows workstations to concurrently run a variety of applications.

- *Multiple MS-DOS applications such as dBase III*
- *CTOS applications such as Document Designer*
- *Third-party software such as Oracle*
- *Communication facilities such as SNA*

The multitasking functionality of CTOS/VM allows users to work on financial modeling while the Series 386i maintains high-speed communications with one or more distant mainframes, processes commands for an internal database, and continuously monitors incoming electronic mail. Applications requiring an unusually large amount of memory can use up to 24 MB of Series 386i memory, excluding that used by the operating system. This extraordinarily large memory capacity allows more CTOS/VM programs to remain in memory, resulting in greater individual productivity.

The design of the Series 386i factors in comprehensive throughput requirements of a workgroup or departmental processor, including the traditional weak point of most systems – the inability to quickly move data *within* the system. Four foundation components critical to overall performance are processor speed, available memory, bus bandwidth, and disk access speed.

Processor speed can be evaluated in terms of clock speed, or number of possible CPU cycles per second, number of wait states incurred, and availability of a numeric coprocessor for executing floating-point operations. By using the fastest available 32-bit microprocessor in a system designed with a highly efficient cache and a 32-bit memory data path, the Series 386i provides the fastest available clock speed with the minimum number of wait states. Use of the Intel 80387 numeric coprocessor operating at 20 MHz gives a level of floating point performance that exceeds the needs for most business and technical applications.

Key performance areas relating to memory operation include the amount of memory available, the speed at which information can be provided to the processor, and the availability of an operating system that can take advantage of the available memory.

The Series 386i provides up to 24 MB of high-speed, 32-bit RAM, and a separate 32-bit data path between memory, cache, and the processor, giving a 33 percent increase in available memory over most products. And CTOS/VM is one of only two commercially available operating systems that can address this much memory.

Bus bandwidth controls the speed at which information can be moved from the processor to and from I/O devices – another area where most systems fail. To reduce any possibility of bottlenecks at this crucial point, the Series 386i provides two separate peripheral I/O bus paths: a high-speed, industry-standard Small Computer Systems Interface (SCSI) serving system mass storage, and Convergent's 10 MB/sec X-Bus™ interface for additional mass storage, voice processors, and communications interfaces such as Ethernet. In addition to the two peripheral buses, the Series 386i has a separate DMA path for cluster LAN connections.

The final area of system bottleneck is the access speed from the disk to the processor. The use of a dedicated SCSI bus for mass storage, and the latest in Winchester disk technologies, allows the Series 386i to outperform other 386-based systems.

The balanced combination of hardware performance and software functionality make the Series 386i one of the most powerful workstations/servers available in today's market.

SYSTEM OVERVIEW

The Series 386i is a single-board system, making use of the Intel 80386 microprocessor operating at 20 MHz. Use of a 16 KB write-through cache allows the Series 386i to perform with zero wait states for all memory read, and most memory write, operations.

The base configuration of the Series 386i includes:

- 4 MB RAM (expandable to 24 MB)
- One 5.25-inch high-capacity floppy drive
- 140 MB (23 msec) or 320 MB (18 msec) SCSI hard disk drive
- Internal clock with battery backup
- 245W power supply
- 1.84 million bits/sec RS-485 LAN interface
- Two RS-232-C communications ports with full-duplex DMA
- Industry-standard SCSI bus with support for the SCSI Common Command Set
- X-Bus interface for compatibility with NGEN modules
- Three internal X-Bus expansion slots, one video slot, and two peripheral slots
- Socket for optional 20 MHz 80387

Configuration Comparison

	Memory Capacity	Largest OS App.	Memory Data Path	Cache	Clock Speed Used	Communi-cations	I/O Bus	Mass Storage	Max. Stor. Capacity
Series 386i Server									
	24 MB	Up to 23 MB (CTOS/VM)	32 bit	Yes	20 MHz	DMA Local Area Network	Peripherals (X-Bus)	SCSI	2.2 GB
More peripherals available									
Typical PC Server									
	16 MB	Up to 512 KB (DOS) Up to 15 MB (OS/2)	32 bit	Rare	16 MHz –20 MHz		Local Area Network Mass Storage Memory Wide Area Comm.		600 MB

Memory

The Series 386i base module includes a separate printed circuit board containing 4 MB of RAM, with parity error detection, using 1 MB dynamic RAM memory elements. Using 1 MB SIMM memory modules, up to 20 MB of additional RAM can be added. Memory expansion is added in 4 MB increments, and requires no special tools.

Video

The Series 386i video is optional, offering customers more flexibility when choosing the appropriate video or lower cost server configuration. Two video options are available: the GC-102 alphanumeric video that is 100 percent compatible with software written for the NGEN Series 286™ and Series 386™ modules, and the GC-103 video, which provides high-resolution 1024 x 768 monochrome graphics. (A high-performance IBM VGA-compatible GC-104 video option will be available in late 1988.)

The GC-102 module connects to Convergent's VM-002 14-inch monochrome monitor or VC-002 15-inch color monitor and provides the ability to display either monochrome or color text in the following formats:

Column	Row	Cell
80	29	9x12
132	29	7x12
132	34	7x9

The GC-103 module provides connection to the VM-002 monochrome monitor or the VM-003 high-resolution monochrome monitor. With the VM-002 monitor, the GC-103 drives a display of medium (720 x 348) resolution bit-mapped text and graphics – a base resolution significantly greater than that required for the majority of today's business applications.

Attaching the GC-103 to a VM-003 high-resolution monitor provides the ability to display text and graphics in a 1024 x 768 pixel resolution – ideal for those customers with applications using What-You-See-is-What-You-Get (WYSIWYG) text and graphics. Alphanumeric and graphic video operations are performed within an addressable 128 KB bit-map memory. Hardware screen refresh and raster operations are supported to permit the rapid transfer of information between program buffers and the display, and to speed up relocation of information from one part of the display to another – often required for effective window manipulation. The controller also supports smooth scrolling (horizontally and vertically) within a window. Hardware cursor support is provided to reduce software overhead as the cursor moves across the screen under the control of an application program or in response to the movements of a desktop pointing device such as Convergent's optomechanical mouse (PD-001).

Both monitors attach to standard NGEN keyboards (KM-00x) and pointing devices at the base.

MASS STORAGE ARCHITECTURE

Internal Mass Storage Devices

The Series 386i comes with a 5.25-inch half-height, dual-capacity floppy drive with a formatted capacity of 640 KB/1.2 MB. The 5.25-inch drive normally reads and writes using a 96 TPI format, but can also read and write using the 1.2 MB capacity used by the IBM PC AT® and compatibles. In addition, this drive can read low-capacity 48 TPI formatted disks used by the IBM PC and PC XT™. The Series 386i also supports an internal full-height 5.25-inch SCSI disk drive. Options include a 147 MB formatted drive with an average access time of 23 msec, or a 332 MB formatted drive with an average access time of 18 msec.

Both of these drives provide 48-bit ECC error correction, 8 million bits/sec data transfer rate, 16 KB dual-ported buffer with parity error detection, and full SCSI common command set compliance. The SCSI interface addition to the Series 386i system significantly increases the storage capacity and data throughput of an NGEN cluster. The ability to support seven high-performance, high-capacity drives with the SCSI interface enable the Series 386i to access more than 2 GB of data storage. In addition, the use of a highly intelligent interface capable of performing overlapped seeks and efficient management of the bus increases data throughput up to 50 percent while off-loading much of the processing drain from the main CPU traditionally associated with disk I/O.

This increase in data throughput can mean an increase in stations supported by the master workstation and also provides the master with additional CPU cycles to perform background tasks such as running communications servers, print spoolers, and so on. Enhanced I/O performance, combined with increased storage capacity, provides a powerful vehicle for servicing large data processing and PC-server applications.

External Mass Storage

The Series 386i base module can also be used with all NGEN mass storage modules in the 'HD' and 'HX' series, as well as with the NGEN Quarter-Inch Cartridge Tape Module (HB-001). As with NGEN workstations, each 'HX' disk expansion module must connect immediately to the right of an 'HD' disk module with a controller. Up to two 'HD' modules and two 'HX' modules are supported.

X-BUS ARCHITECTURE

Internal X-Bus Expansion

The base module contains three internal slots configured for board versions of X-Bus modules such as the RS-232-C Multiline Port Expander (XC-102) and the Ethernet Controller (XE-101). One of the slots is also optimized for use with the GC-102 or GC-103 video options. Installing these options within the base enclosure eliminates the need for separate power supplies and modules, and therefore reduces the cost of these incremental capabilities. The internal slots also increase available X-Bus length permitted, allowing customers to have more configuration options and a higher degree of flexibility when designing a cluster network. Each internal option saves up to 3 inches of external X-Bus length. Added to the 6 inches of X-Bus length already saved from the internal floppy/hard disk, the effective configured length of the X-Bus increases by 50 percent.

External X-Bus Expansion

Customers who already have X-Bus peripheral modules, or who wish to retain NGEN's flexibility and easy system reconfiguration, can use the external X-Bus connector built into the Series 386i base module.

All standard NGEN modules for voice and data communications, as well as mass storage, can be attached to the external X-Bus of the base module.

POWER REQUIREMENTS

The Series 386i base module contains an integral 245W power supply, which is switch-selectable for nominal 110V or 220V operation. All components within the base module, as well as the keyboard and monochrome displays, are powered via this internal supply. External X-Bus modules are powered separately, using standard NGEN PS-00x power supplies.

PACKAGING

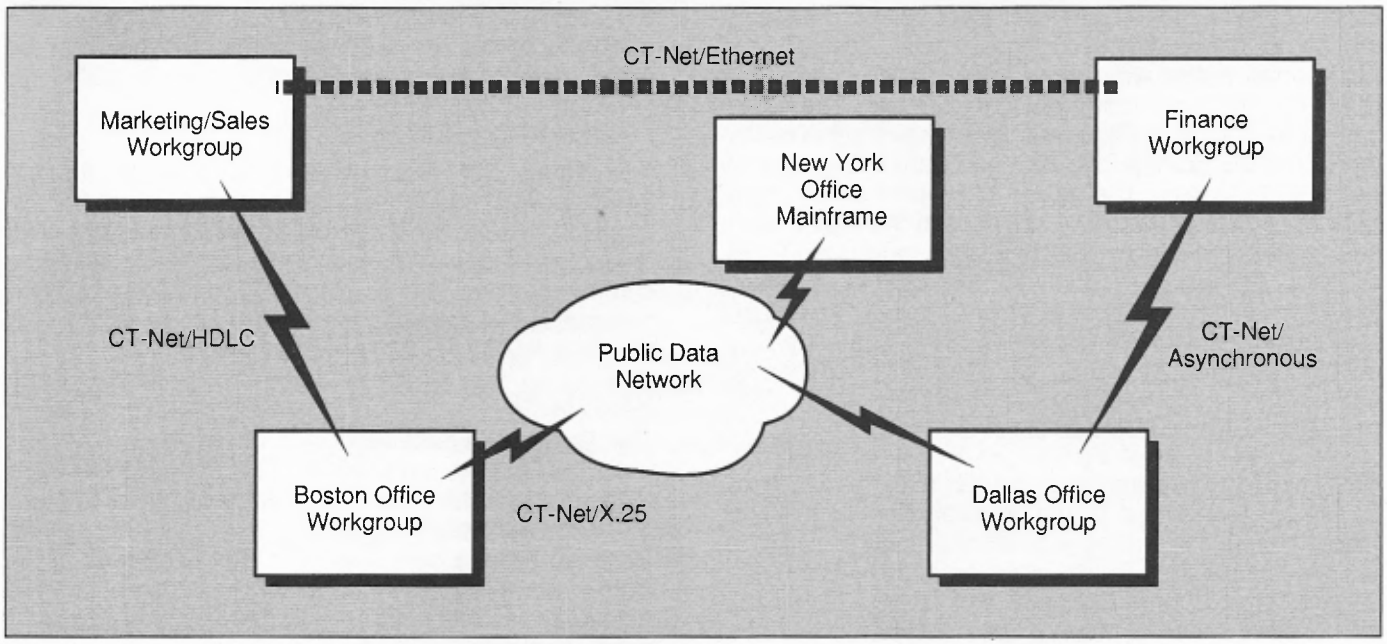
The Series 386i base module is packaged in a 14-inch wide NGEN-style enclosure. The mother board sits horizontally at the base of the enclosure and contains the standard system logic and connectors for the RAM expansion board and internal X-Bus expansion. The disk drives and power supply are mounted above the mother board. All components are easily accessed by removing the top/front cover of the base module, giving the module a clean, uncluttered appearance. Access to the floppy loading mechanism is hidden by a hinged door, which keeps dust from entering the drive and reduces noise from the operating drive. The I/O connectors are accessed from the rear of the base enclosure. RS-232-C, RS-485, video, and parallel ports are mounted along the rear edge of the mother board and covered by a plastic panel to preserve the streamlined appearance of the workstation from all angles of view.

SOFTWARE

The Series 386i processor is serviced by CTOS/VM – the industry's first distributed desktop workstation operating system that features protected mode operation, virtual machine support, and enhanced workgroup networking. Built upon the solid operating system foundation of CTOS introduced in 1980, CTOS/VM combines these unique features with the CTOS-based, industry-proven concepts of multitasking, realtime processing, and message-based task management.

CTOS/VM and all system services are loaded at the top of available memory leaving the remaining memory free for application processing – a significant feature when running real mode applications that can only run in the first megabyte of memory. Typically, operating systems use a large portion of the first megabyte of memory, which severely limits the available application area. Most application programs originally developed and executed under CTOS run in the CTOS/VM environment *without* change – a degree of cross-system application compatibility unmatched in today's desktop workstation industry.

In addition to supporting Convergent's comprehensive library of software applications, CTOS/VM can (in combination with PC Emulator software) run software written for the IBM PC, the Network PC™, and other IBM compatibles.



Used in conjunction with Context Manager™, CTOS/VM allows the Series 386i to invoke multiple MS-DOS virtual machines – that is, 8086-based PCs existing *virtually* within the 80386-based NGEN. These virtual machines coexist with other Convergent and customer/user applications.

Internationalization

CTOS/VM uses an effective internationalization support scheme that consists of a series of utilities, runtime libraries, system calls, and data structures used during portation and/or conversion of foreign language translations. Software can be translated into most European languages without modification to run files.

Development Environment

The unique characteristics CTOS/VM provides Convergent customers with a development environment that is second to none. The message based architecture allows for quick generation of distributed networked applications; the ability to make use of all available memory provides the developer with much more flexibility to write complex applications; and the ease of internationalization allow customers to quickly bring new applications to a variety of markets.

Languages

- C
- FORTRAN
- Pascal
- BASIC
- COBOL
- Assembler

Data Management Facilities

- ISAM
- Sort/Merge
- Forms Package

Communications Services

- BSC 2780/3780
- BSC 3270
- SNA (interactive and RJE)
- X.25

CONVERGENT CLUSTER

CTOS/VM supports a unique built-in LAN for connecting NGEN workstations and PC's. The cluster increases user productivity and reduces per-user-cost by sharing data and program files, communications facilities, and links to remote resources. Stations connect through Convergent's low-cost, high-speed cable or through the TeleCluster™, which allows workstations to be added to the network through existing phone lines. The modular structure of CTOS/VM provides the ideal environment for a distributed architecture. By separating the operating system into several processes that communicate via messages, workstations can exchange information using high-speed communications lines operating at 1.84 million bits/sec.

CTOS/VM allows the Convergent master workstation to perform the duties and responsibilities of a network server *and* address the needs of the individual using the workstation – dual-purpose functionality not available in most other networked product offerings.

CT-NET SUPPORT

CT-Net™ is a logical extension of the Convergent cluster that establishes transparent peer-to-peer connections among CTOS master workstations. In conjunction with CT-Net, CTOS/VM allows the connection of workgroups that are made up of different configurations, different workstation processors, and different applications software. The culmination of these Convergent-specific capabilities places the Series 386i at the forefront of the desktop workstation industry.

PROCESSOR

Module	Processor	Clock Rate
PHD-140/320	80386	20 MHz
OP-387 (optional)	80387	20 MHz

MEMORY

Module	Base	Maximum	ROM
PHD-140/320	4 MB	24 MB	16 KB
XM-040	4 MB	--	--

STORAGE CAPACITY

Module	Floppy	Hard	Maximum
PHD-140	0.64/1.2 MB	147 MB	2,139 MB
PHD-320	0.64/1.2 MB	332 MB	2,324 MB

I/O RATES

Serial RS-232-C

External: 110 bps to 19,200 bps
Internal: 50 bps to 19,200 bps

Serial RS-485

Internal: 100 bps to 1.8 Mbps

Parallel

Programmed: 9600 chars/sec (typical)

ELECTRICAL

115V: 95 to 130 Vrms
5.6A at 47 to 63 Hz
230V: 200 to 260 Vrms
2.8A at 47 to 63 Hz

The AC loads specified represent the loads presented to the line by a fully configured system.

PHYSICAL

Height: 8 in. (203 mm)
Width: 14 in. (355 mm)
Depth: 12 in. (305 mm)
Weight: 25 lb (12 kg)

REGULATORY

Safety

Meets UL 478 (Business Equipment)
Meets CSA 154 (EDP) and 143 (Office Equipment)
Meets VDE 0806/8.81 (Office Equipment)
Meets IEC 380 (Office Equipment)

Emissions

Meets VDE 0871/6.78, Class A
Meets FCC Part 15, Subpart J, Class A

ENVIRONMENTAL

ESD

5,000V: No observable effect
15,000V: No operator-perceived errors
25,000V: No permanent damage

Ambient Temperature/Relative Humidity

Operating: 10°C to 40°C
20% to 80%, noncondensing
Non-operating: -40°C to 60°C
10% to 90%, noncondensing

Altitude

Operating: 10,000 ft ASL
Non-operating: 30,000 ft ASL

Shock

Non-operating: 10 g

Acoustic Noise Level

55 dB(A) max

Heat Dissipation

908 BTUs

Transportation

Packaging and shipping containers and procedures comply with the current NSTA preship test procedures.

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