SONY

INTERNAL USE ONLY

TECHNICAL MANUAL

Third Edition

-First Printing-

NEWS

NETWORK STATION

- NEWS is a registered trademark of Sony Corporation for its workstation and operating system.
- UNIX and system V are registered trademarks of AT&T in the USA and other countries.
- Ethernet and XNS are trademarks of Xerox Corporation.
- NFS is a product created and developed by Sun Microsystems, Inc. and is a trademark of Sun Microsystems, Inc.
- Smalltalk-80 is a trademark of Park Place Systems.
- MS-DOS is a registered trademark of Microsoft Corporation.
- VMEbus is a registered trademark of Motorola, Inc.
- Trinitron is a trademark of Sony Corporation.
- X Window System is a trademark of MIT.
- VMS is a trademark of Digital Equipment Corporation.
- The MIPS value is determined in comparison with the performance of VAX 11/780 measured using the Dhrystone program. VAX is a registered trademark of Digital Equipment Corporation.
- MIPS, R3000 and R3010 are registered trademarks of MIPS Computer Systems, Inc.
- Videomap is a trademark of Sony Corporation.
- OSF/Motif and Motif are registered trademarks of Open Software Foundation, Inc.
- OS/2 is a trademark of International Business Machines Corporation.
- CDFF and CDIF are registered trademarks of Sony Corporation.
- NEWS-OS, NEWS Desk, CISC NEWS and RISC NEWS are trademarks of Sony Corporation.

Third Edition, 1991, March.
First Printing 1991, March.

SMSG0071TEC9103P1-000.5

Preface

This manual has been prepared to give our readers an overview of the NEWS Series of products provided by Sony Corporation.
The material in this manual overlaps that of other documents such as catalogues. However, given the intention of this manual, it should provide a more focused outline of the technical details needed by the system engineer.

We hope that our readers may utilize this manual as a handy reference to grasp the whole picture of the NEWS Series of products, and, as required, augment their knowledge on more detailed specifications from the various product manuals themselves.

Manuals:

The following Manuals are available with the NEWS Series:

1) NEWS-OS Release 4.0 Manual Set (NWM-660)

This manual consists of the following six guides:

NEWS-OS User's Guide

Describes functions and commands unique to NEWS-OS. This guide is for the beginners who use a NEWS workstation at the command level.

NEWS-OS Programmer's Guide

Describes the libraries unique to NEWS-OS. It also contains guides and causions for porting system between RISC and CISC workstations.

NEWS-OS Administrator's Guide

This contains the information necessary for the system administrations, such as files and environments settings, device management, network management, diskless workstation setups and so on.

NEWS-OS X Window System User's Guide

This is a guide for using X Window System on NEWS-OS. Covers from basic operations of X to advanced management information.

NEWS-OS I/O Device Programming Guide

This is a guide for the I/O devices supported on NEWS-OS. This guide is for the programmers who program at the device driver level.

NEWS-OS NEWS Desk User's Guide

Describes the basic operations and administrative information on NEWS Desk.

2) NEWS-OS Reference Manual (NWM-645)

The NEWS-OS Reference Manual offers detailed explanations of NEWS-OS. An on-line version of the manual is also available for referencing on the NEWS console display.

The contents are following.

User's Reference Manual (suitable for "/usr/man/C")

User's Supplementary Documents

Programmer's Supplementary Documents

System Manager's Manual

NFS™ Documentation

X Window System (V11.R4)

3) Hardware Instruction Manual

Included in each package of the NEWS main unit and the various peripheral equipment. A Hardware Instruction Manual gives cautions, necessary setups, major specifications, etc.

4) Service Manual

The Service Manual is designed for use by a service technician and contains Circuit Diagrams, Parts Lists, Usage of Diagnostic Software, etc.

5) Sales Manual

The Sales Manual presents an overview of the products and is used in marketing the NEWS Series. A part of the Sales Manual overlaps this Manual.

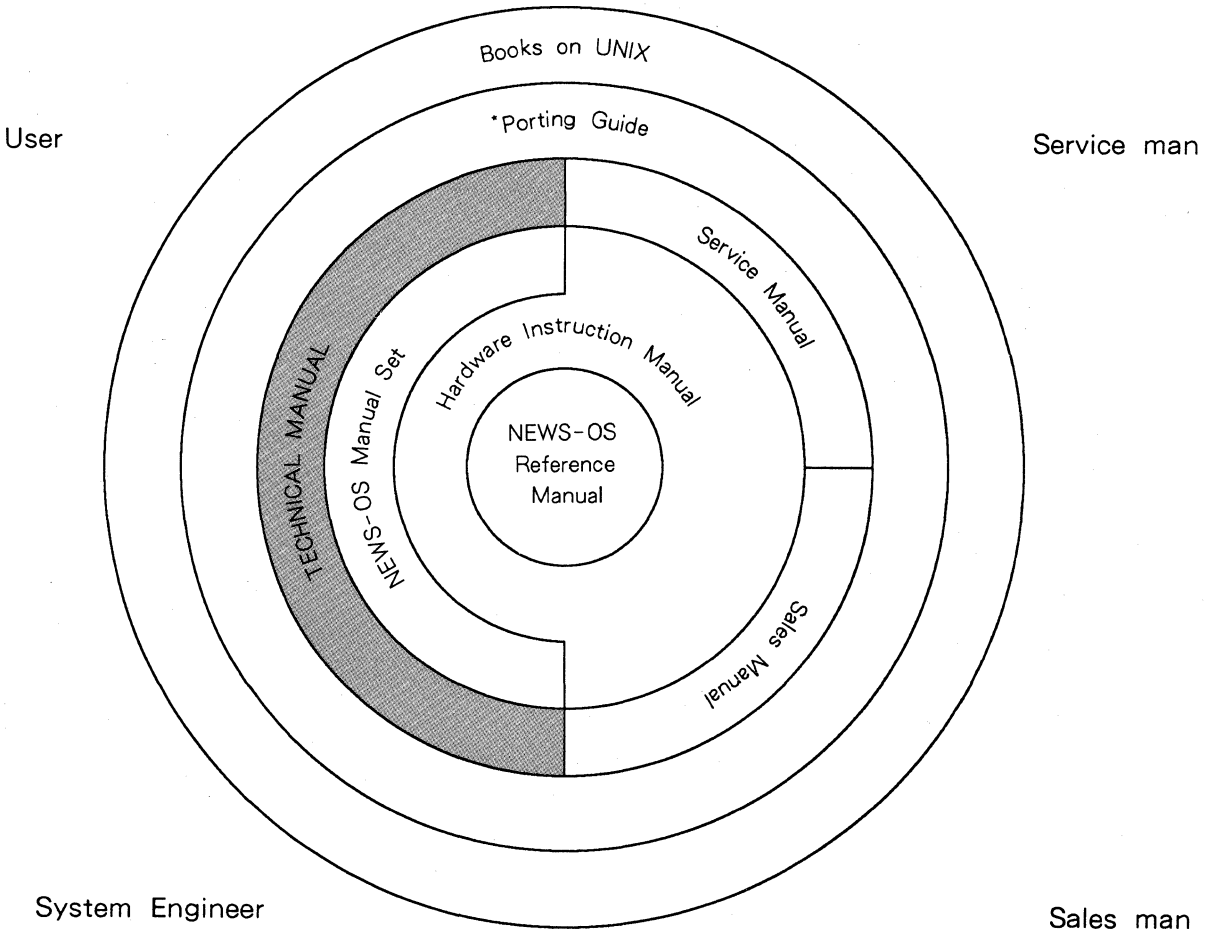
General explanatory books on UNIX are available in bookstores. A number of introductory texts are also published from AT&T.

Positioning of Technical Manual

Fig. 1 represents the relationship between the Manuals described above along with the people who will use them. The coverage of the Technical Manual is indicated by the shadowed area.

As you go move inwards into the circle, you encounter more sophisticated details.

Fig. 1 Manual and Users



*Porting Guide

Brief outline of NEWS-OS is described. Shows the structure and concept of NEWS-OS. Presently under preparation.

What this Manual Contains

This manual has six chapters.

Chapter 1 **Introduction**— Tells you about the basic features of the NEWS product family.

Chapter 2 **Software Issues** — Discusses software issues, such as disk storage requirements, brief outlines of each NEWS-OS Release Version, etc.

Chapter 3 **Network Issues** — Discusses network server issues.

Chapter 4 **I/O Interfaces** — Gives an overview of several I/O interface features, including the VMEbus, serial port, and Ethernet information, etc.

Chapter 5 **Power Requirements** — Describes the power requirements of the NEWS products. It tells you how to calculate current consumption of your configured system.

Chapter 6 **NEWS Series Performance**— Describes results of NEWS benchmark testing.

Note: This manual describes all NEWS system-related products. The products may not be available on some markets. Please consult your area NEWS representative for information on product availability.

TERMS USED IN THE TECHNICAL MANUAL (Alphabetical Order)

AI	: Artificial Intelligence
ANSI	: American National Standards Institute
ASCII	: American Standard Code for Information Interchange
AT&T	: American Telephone & Telegram
BBS	: Blettin Board System
BSD	: Berkeley Software Distributions
CAD	: Computer-Aided Design
CAE	: Computer-Aided Engineering
CAI	: Computer Assisted Instruction
CAM	: Computer-Aided Manufacturing
CASE	: Computer-Aided Software Engineering
CCITT	: Commité Consultatif International Télégraphique et Téléphonique
CD	: Compact Disk
CDFF	: Common Document File Format
CDFS	: CD-ROM File System
CD-ROM	: Compact Disk-Read Only Memory
CGI	: Computer Graphic Interface
CISC	: Complex Instruction Set Computer
CPU	: Central Processing Unit
DAT	: Digital Audio Tape
DDS	: Digital Data Storage
DPI	: Dots Per Inch
DRAM	: Dynamic Random Access Memory
DTP	: Desktop Publishing
EIA	: Electronic Industries Association
EK	: Europe and United Kingdom
FD	: Floppy Disk
FDC	: Floppy Disk Controller
FDD	: Floppy Disk Drive
FDDI	: Fiber Distributed Data Interface
FFFS	: Fat Fast File System
FPCP	: Floating Point Co-Processor
GP-IB	: General Purpose Interface Bus
HD	: Hard Disk
HDD	: Hard Disk Drive
I/O	: Input/Output
IEEE	: Institute of Electrical and Electronics Engineers
IOP	: Input/Output Processor
IP	: Internet Protocol
IPC	: Inter Process Communication
ISDN	: Integrated Services Digital Network
J	: Japan

JIS : Japanese Industrial Standards
KDD : Kokusai Denshin Denwa Kabushikigaisya
(Japanese Telephone & Telegram Co.)
LBP : Laser Beam Printer
LCD : Liquid Crystal Display
LSI : Large Scale Integrated Circuit
MFDD : Micro Floppy Disk Drive
MIC : Microphone
MIPS : Millions Instructions Per Second
MMU : Memory Management Unit
MO : Magneto Optical
MPU : Mathematical Processing Unit
MT : Magneto Tape
NFS : Network File System
NHK : Nippon Housou Kyoukai
(Japanese Broadcasting Association)
NIS : Network Information Service
NTSC : National Television Systems Committee
cf.) PAL : Phase Alternation by Line
NTT : Nippon Telephone & Telegram
OCR : Optical Character Recognition
OHP : Over Head Projector
OS : Operating System
PCFS : PC File System
RAM : Random Access Memory
RFC : Request For Comments
RGB : Red, Green and Blue
RISC : Reduced Instruction Set Computer
ROM : Read Only Memory
SCC : Serial Communications Controller
SCSI : Small Computer System Interface
SNMP : Simple Network Management Protocol
SRAM : Static Random Access Memory
TCP : Transmission Control Protocol
TTL : Transistor Transistor Logic
UC : US and Canada
UUCP : Unix to Unix Copy
VME : Versa Module Europe
VTR : Video Tape Recorder
XNS : Xerox Network System
YP : Yellow Page
bps : Baud rate per Second
ch : channel

Chapter 1

Introduction

In this chapter, the line-up of the NEWS series products is discussed and explained. The line-up encompasses the whole series of NEWS products, including the main units, peripherals, boards, accessories, etc. Largely, the products can be classified according to the following product codes:

NWS-	-for System	**NWB-**	-for Board	**NWM-**	-for Manual
NWP-	-for Peripheral	**NWA-**	-for Accessories	**NWF-**	-for Software
NWE-	-models available only in Europe			**NWU-**	-models available in USA

Contents

1.1 Sony NEWS Series Overview

The full line-up of the NEWS series provides users with opportunities to procure systems matching their respective requirements while economizing on costs. The NEWS series is based on open distributed processing technology, and supports all integral technologies.

- CASE (Computer-Aided Software Engineering)
- DTP (Desktop Publishing)
- CAD/CAM/CAE
- Database Management Systems
- AI (Artificial Intelligence)
- Communications
- Graphics
- Office Automation, etc.

All of the above applications are powerfully supported by the availability of high performance peripherals and supporting software. For more information on third party software, refer to the "Sony SYNERGY CATALOG".

1.2 Basic Hardware

The NEWS family is a group of 32-bit systems. The NWS-700/800 series models are based on the Motorola MC68020 CPU chip and the MC68881 floating-point coprocessor. The NWS-900 series models are based on the MC68020 CPU chip and the MC68882 floating-point coprocessor.The PWS-1500 series models are based on the Motorola MC68030 CPU chip and the MC68881 floating-point coprocessor.

The NWS-1200/1400/1500/1700/1800/1900 series and PWS-1600 series models are based on the Motorola MC68030 CPU chip and the MC68882 floating-point coprocessor.

The NWS-3200/3400/3700/3800 series are based on the MIPS R3000 CPU and the R3010 floating-point accelerator.

All NEWS workstations have an integrated Ethernet interface for local area networking.

1.3 Operating System

Enhanced Operating System

The operating system is based on the universally accepted UNIX 4.3 BSD, NFS Release 4.0 and X Window System Version 11 Release 4.

UNIX 4.3 BSD: UNIX 4.3 BSD is the upgraded Berkeley version of UNIX. Using this version, the overhead of the operating system has been reduced considerably, while the number of mountable file systems and the number of open files per process have been increased. The compiler and its related libraries have been rewritten for higher performance. The arithmetic libraries have also been modified for the utmost in processing speed and precision. Communication protocols supported by UNIX 4.3 BSD include XNS of Xerox Corporation, and TCP/IP.

NFS Rel. 4.0: Release 4.0 of NFS (Network File System) not only enables file access across the network without the need for file transfer but also allows file locking when the same file is accessed simultaneously by two or more users.

X Window System Version 11 Release 4: With improved graphics capabilities, this multi-window system is especially suited for mechanical and electronic computer-aided design, desktop publishing, and other applications that require high graphics performance. A newly added tool kit called "Xt" makes application development easier than ever.

1.4 Features

All NEWS workstations feature:

- Full 32-bit architecture
- At least 4 megabytes of main memory, with some workstation memories expandable to 128MB.
- Integrated Ethernet interface
- Support for standard software

  Operating System: NEWS-OS Release 4.0 (UNIX 4.3 BSD + X Window System Ver. 11 Release 4 + NFS Rel. 4.0)

  Communications: TCP/IP + XNS

  Languages For CISC Series: C, Fortran 77, Franz Lisp, Pascal.

  For RISC Series: C. Fortran and Pascal are optional.

  Graphical User Interface: OSF/Motif, NEWS Desk

- SCSI*1, RS-232C (×2)*2, Centronics Parallel*3

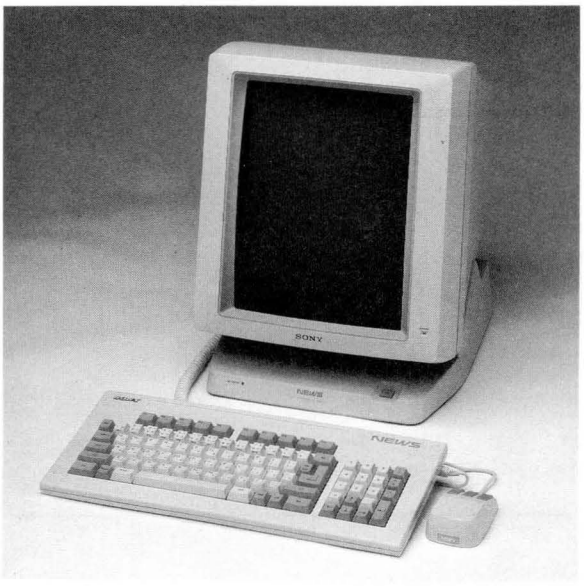
*1: NWS-3800 Series has 2ch.
*2: NWS-1200/3200 Series have 1ch.
*3: Except NWS-700 Series.

1.5 System

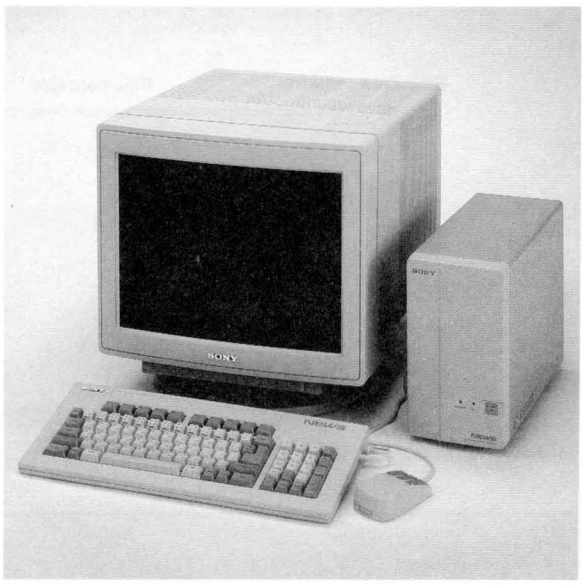
The following explanation covers the NEWS series workstations. For more detailed information on each product, please consult the relevant instruction manual.

For performance comparisons, please refer to the Table 1.5-1 NEWS system performance comparisons.

See Chap. 5 for a summary of power requirements.



NWS-711



NWS-721

The NWS-700 Series is designed to serve as a diskless node to be networked with other machines.

1. The NWS-700 Series has these standard features:

- MC68020 CPU
- MC68881 floating-point coprocessor
- Built-in Ethernet controller

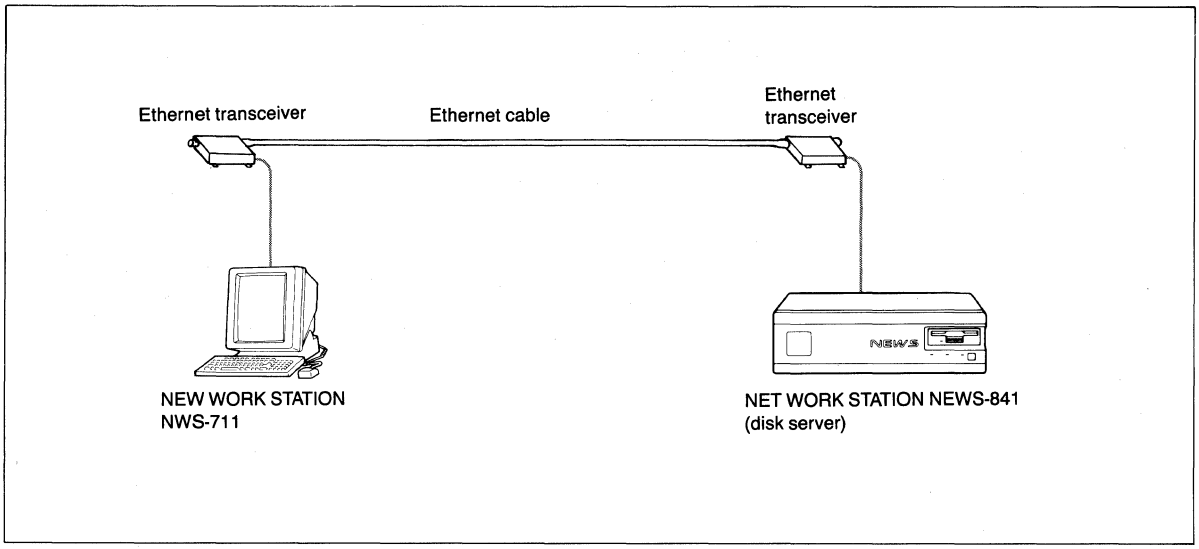
2. Comparison of NWS-711, NWS-712 and NWS-721

Model	MIPS	CPU Clock Speed	Coprocessor Speed	Display	Main Memory
NWS-711	2.3	16.67MHz	16.67MHz	15″ (14″ viewable) monochrome	4MB
NWS-712	2.8	20MHz	20MHz	15″ (14″ viewable) monochrome	4MB Expandable to 8MB
NWS-721	2.8	20MHz	20MHz	17″/20″ Color	4MB expandable to 8MB

3. Setting Up the System

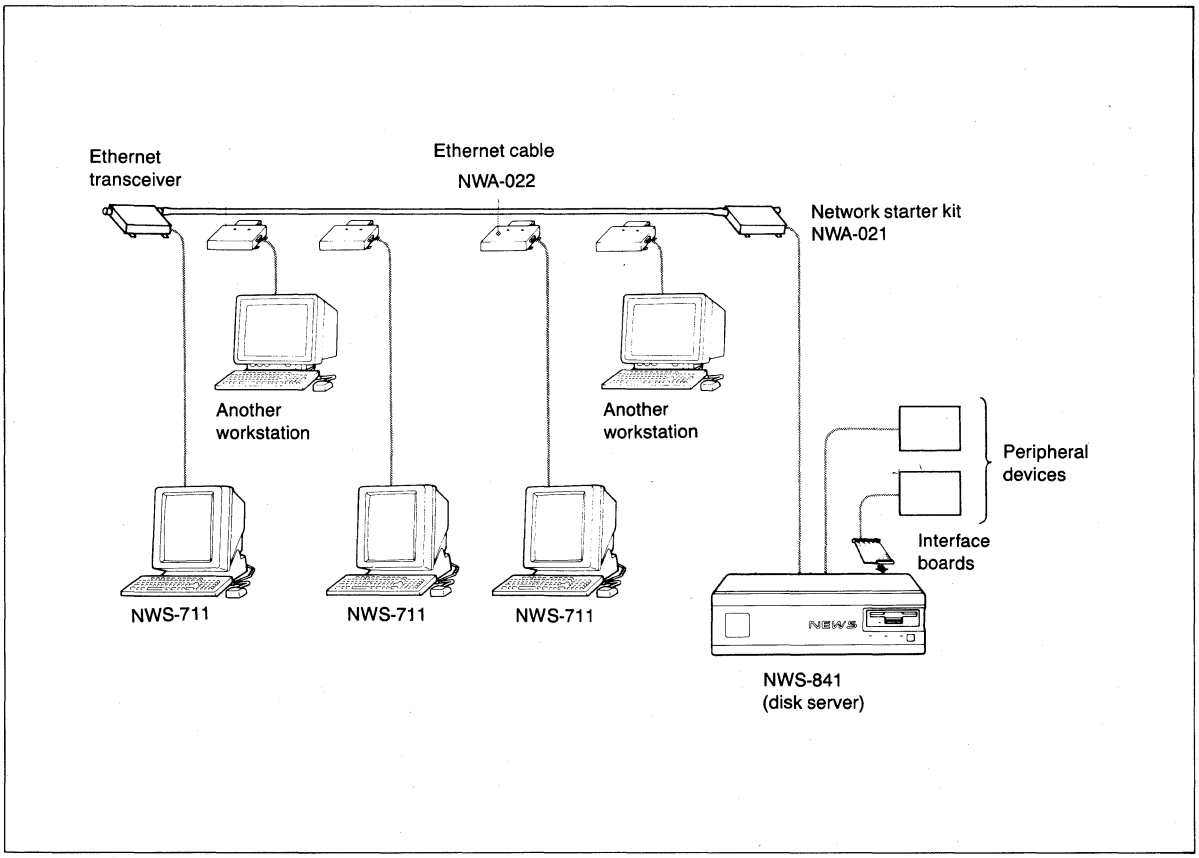
1) Basic System

This is the basic system consisting of the components necessary to set up the NWS-711.



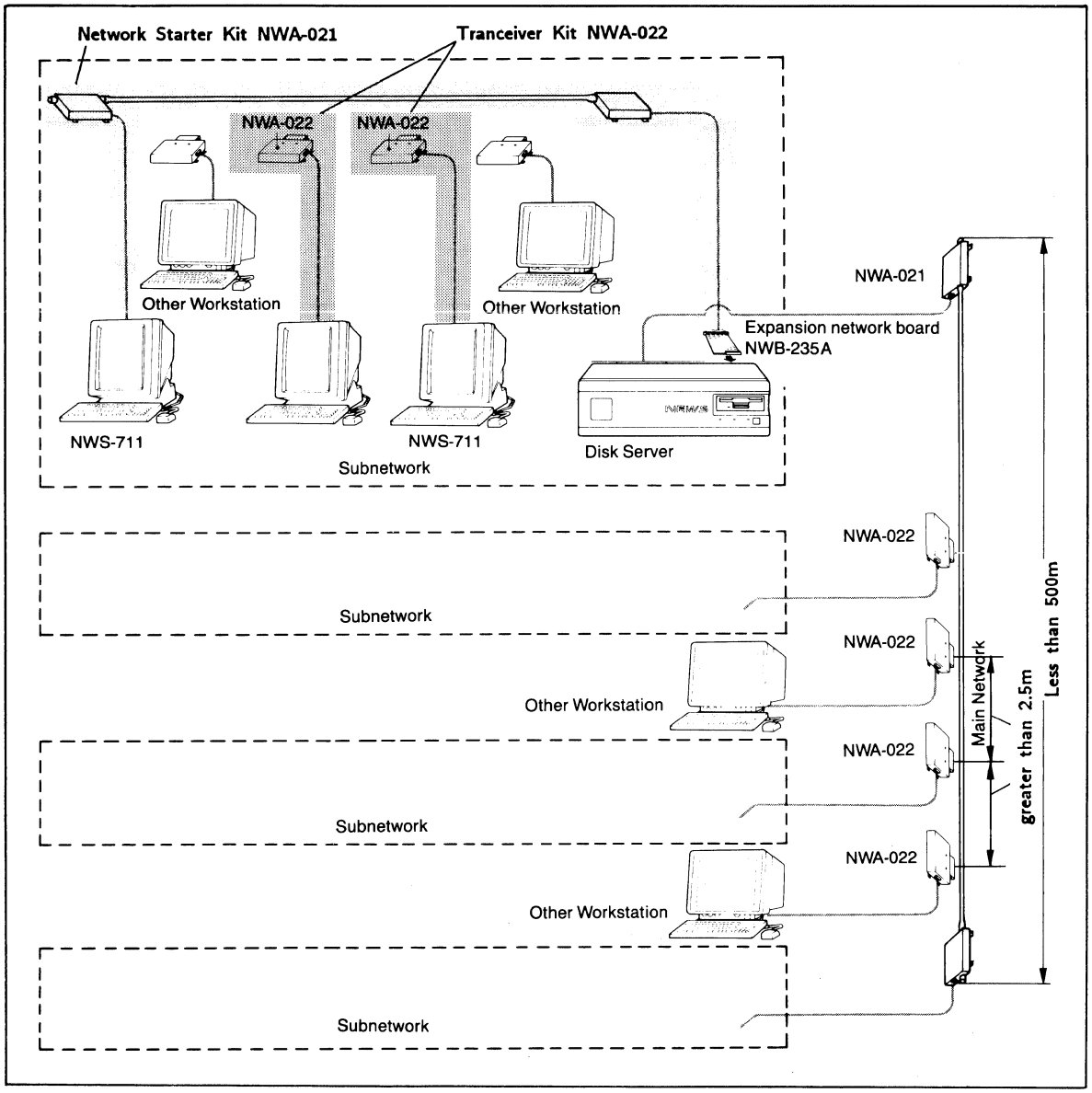
2) Multiple System

- Workstations other than the disk server can be included in one network.
- The NWS-711 can share peripheral devices that are connected to other workstations or the disk server.



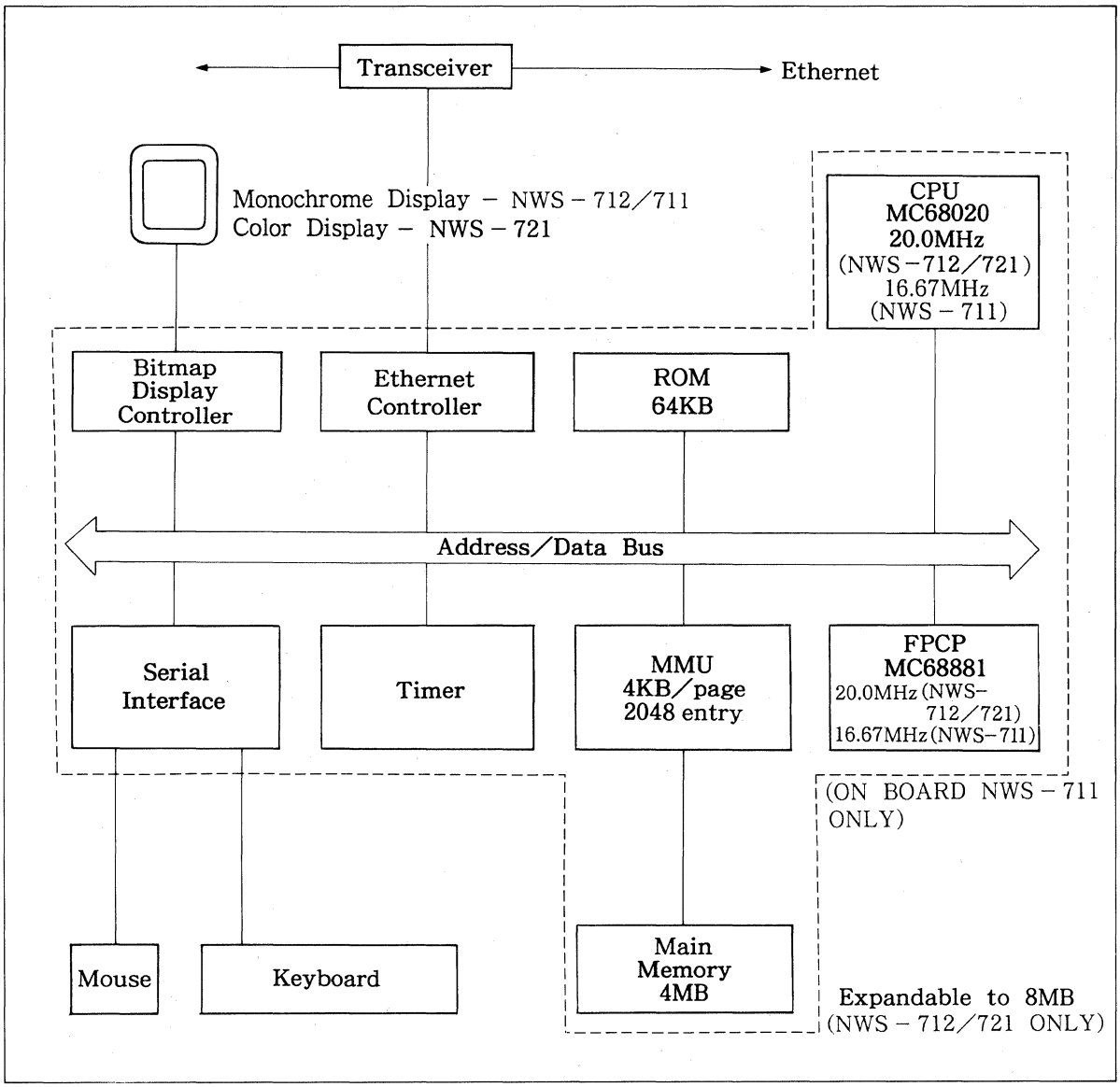
3) Advanced System

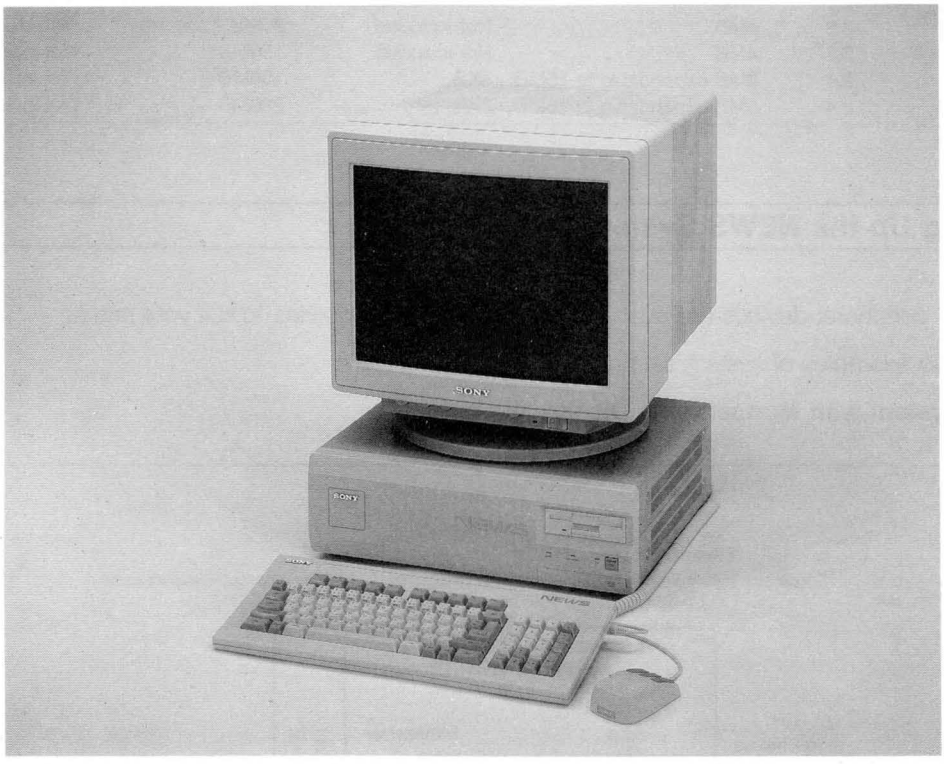
The following is an example of an advanced system constructed by inserting expansion network board NWB-235A into the disk server.



- This local area network follows IEEE S02.3 and ethernet protocol.
- Data transfer rate is 10 Mbps. Access method is CSMA/CD.
- MAX ethernet length is 500m.
- Each terminal should be connected at intervals greater than 2.5m.

4. Block Diagram





NWS-841

The original model for the NEWS workstation. The NWS-800 Series, includes five models from which the system engineer can choose according to his or her needs.

1. The NWS-800 Series has these standard features:

- Dual-processor architecture using two 16.67MHz MC68020s
- 16.67MHz MC68881 floating-point coprocessor
- 2.3-2.4 MIPS system performance
- Large capacity hard disk drive (excluding NWS-811)
- 1.44-Mbyte 3.5-inch floppy disk drive
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial ports
- Built-in parallel port for printer connection
- Built-in SCSI bus for external storage devices
- Two expansion slots
- NWS-891 is equipped with CD-ROM

2. Comparison of NWS-811, NWS-891, NWS-821, NWS-831 and NWS-841

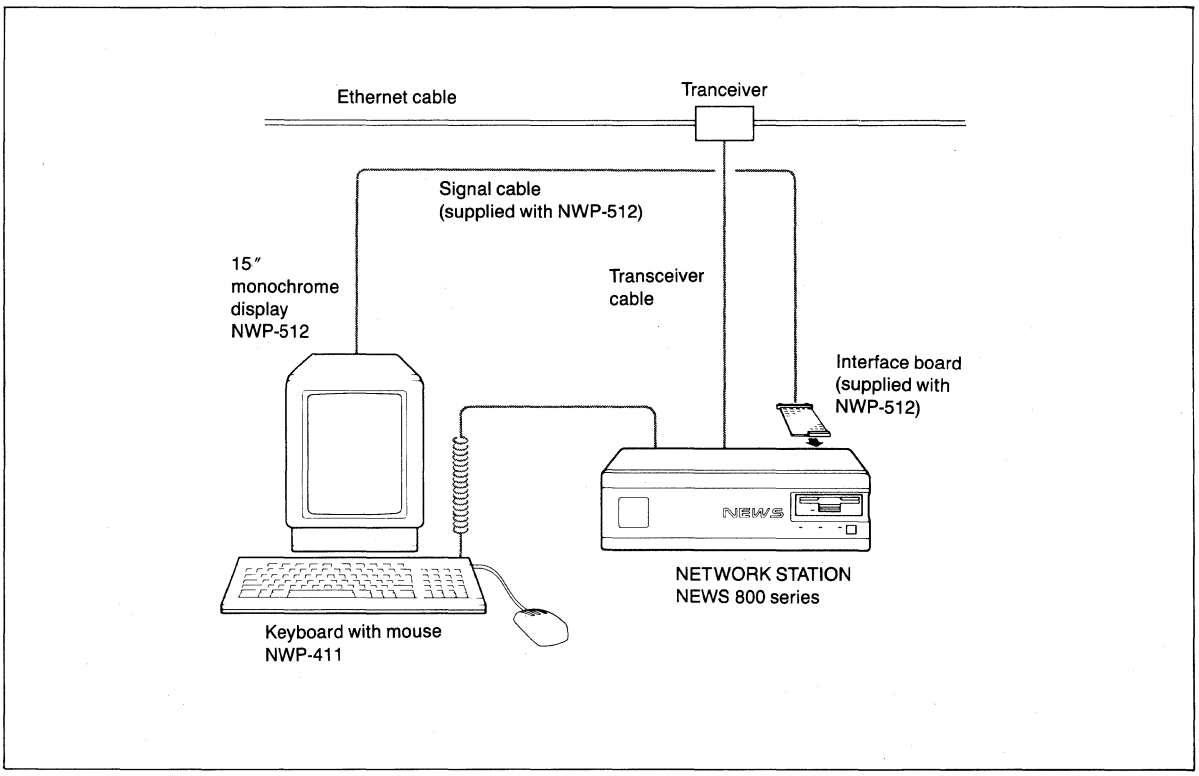
Model	MIPS	Main Memory	Cache Memory	HDD	CD-ROM
NWS-811	2.3	4MB	Not included	Not included	Not included
NWS-891	2.3	4MB	Not included	86MB	540 MB
NWS-821	2.3	4MB	Not included	156MB	Not included
NWS-831	2.4	8MB expandable to 16MB	8KB	156MB	Not included
NWS-841	2.4	8MB expandable to 16MB	8KB	286MB	Not included

3. Setting Up the NEWS System

A variety of peripheral devices are available for the NEWS 800 Series to suit your needs.

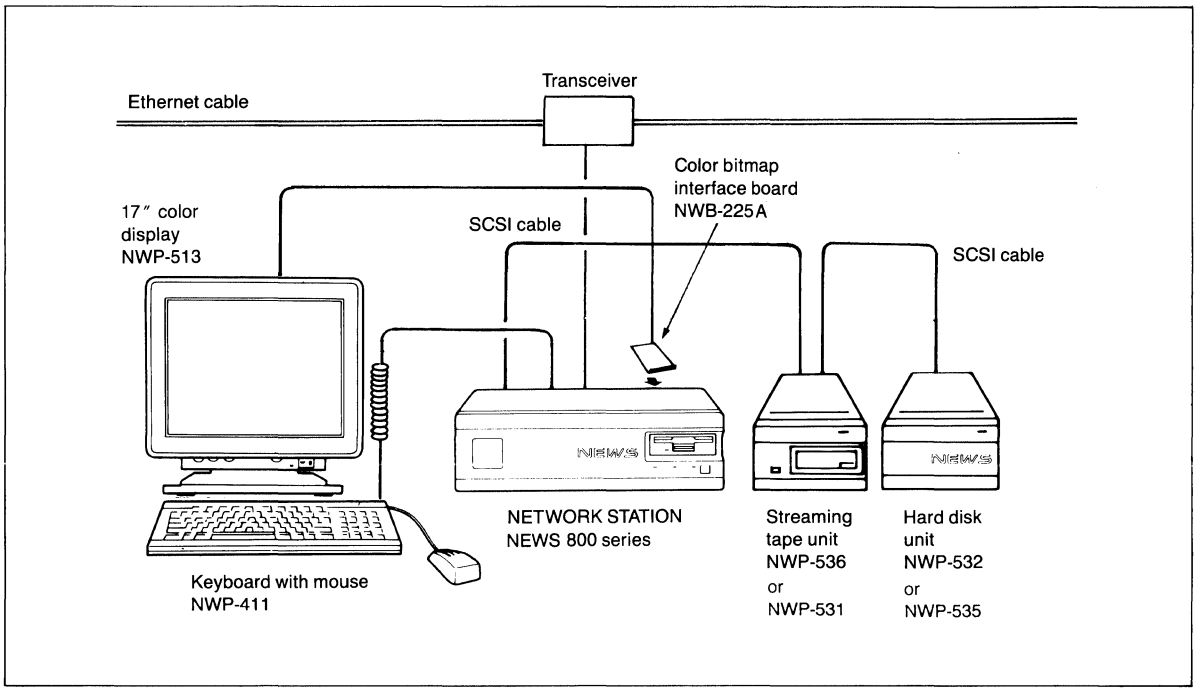
Here are two examples of system set-up.

1) Basic System with Monochrome Display



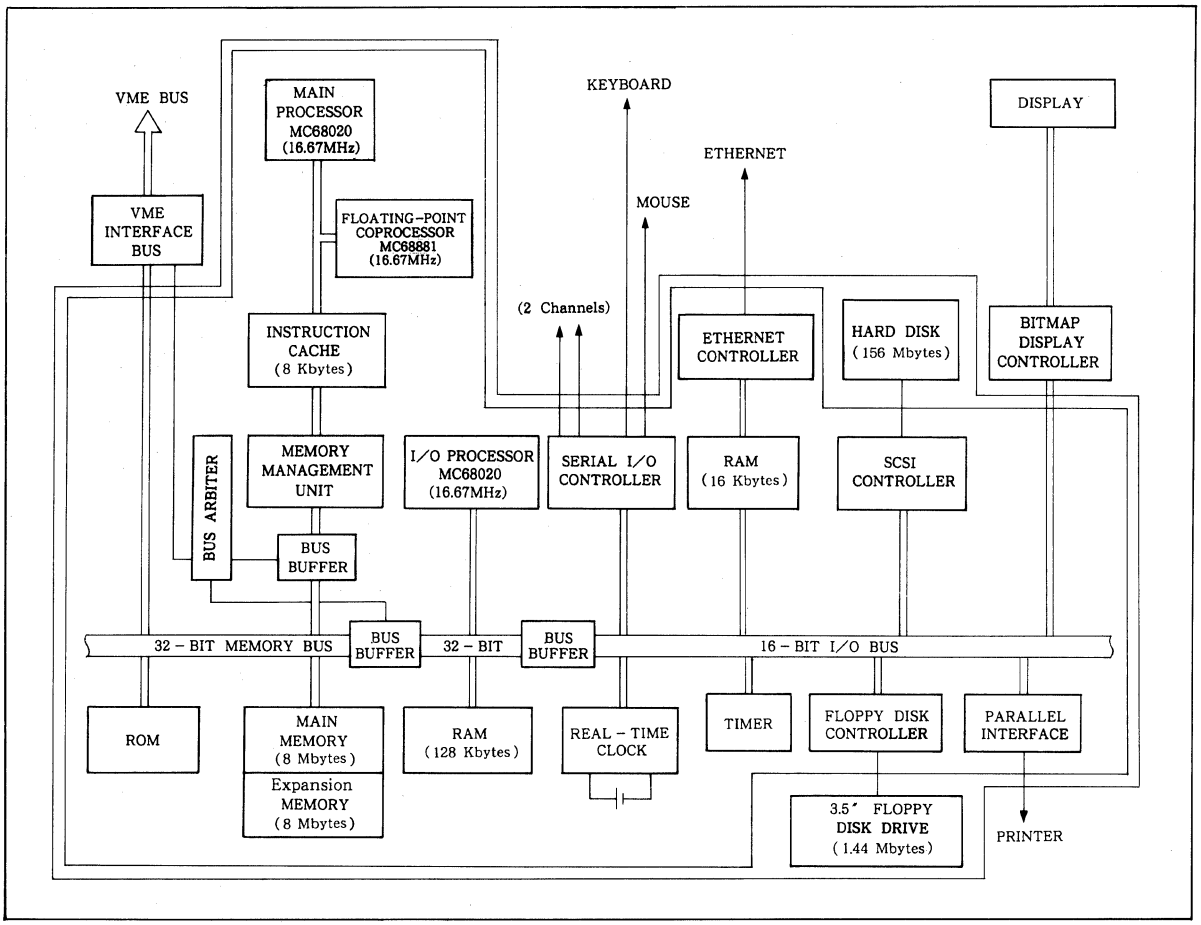
When the NEWS 800 Series is used in a stand-alone system, the Ethernet transceiver illustrated above is unnecessary.

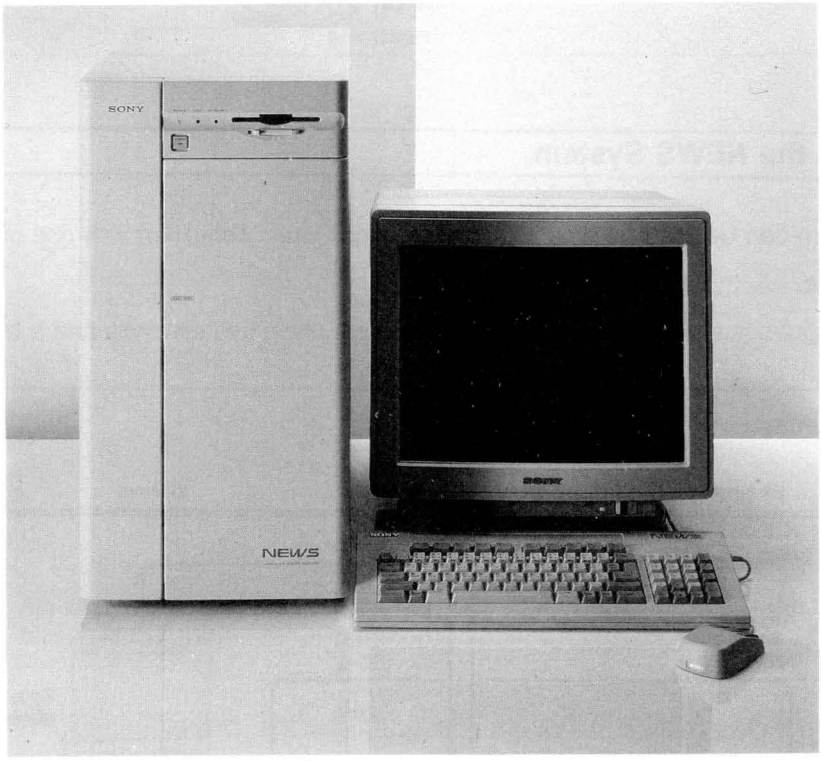
2) Expanded System with Color Display



Note: • VME interface board (NWB-234A) should be installed in the lower slot.
• When using NWB-225A (Color Bitmap Interface) with NWB-280 (4 Plane Color Expansion) two expansion slots become full.

4. Block Diagram [NWS-831]





NWS-911

Featured in the NWS-900 Series is an internal 125-Mbyte streaming tape drive and a hard disk capacity of 1.1 Gbytes (for NWS-921). Also included are VME slots for four triple height Eurocards and four option board slots, offering expandability to a more advanced system.

1. The NWS-900 Series has these standard features:

- Dual-processor architecture with two 16.67MHz MC68020s
- 20MHz MC68882 floating-point coprocessor
- 2.4 MIPS system performance
- 8 Mbytes of main memory, expandable to maximum of 16 Mbytes
- 8-Kbyte cache memory
- 125-Mbyte streaming tape drive
- 1.44-Mbyte 3.5-inch floppy disk drive
- Large capacity hard disk drive
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial ports
- Built-in parallel port for printer connection
- Built-in SCSI bus for external storage devices
- VME bus architecture (Four slots)
- Four expansion slots

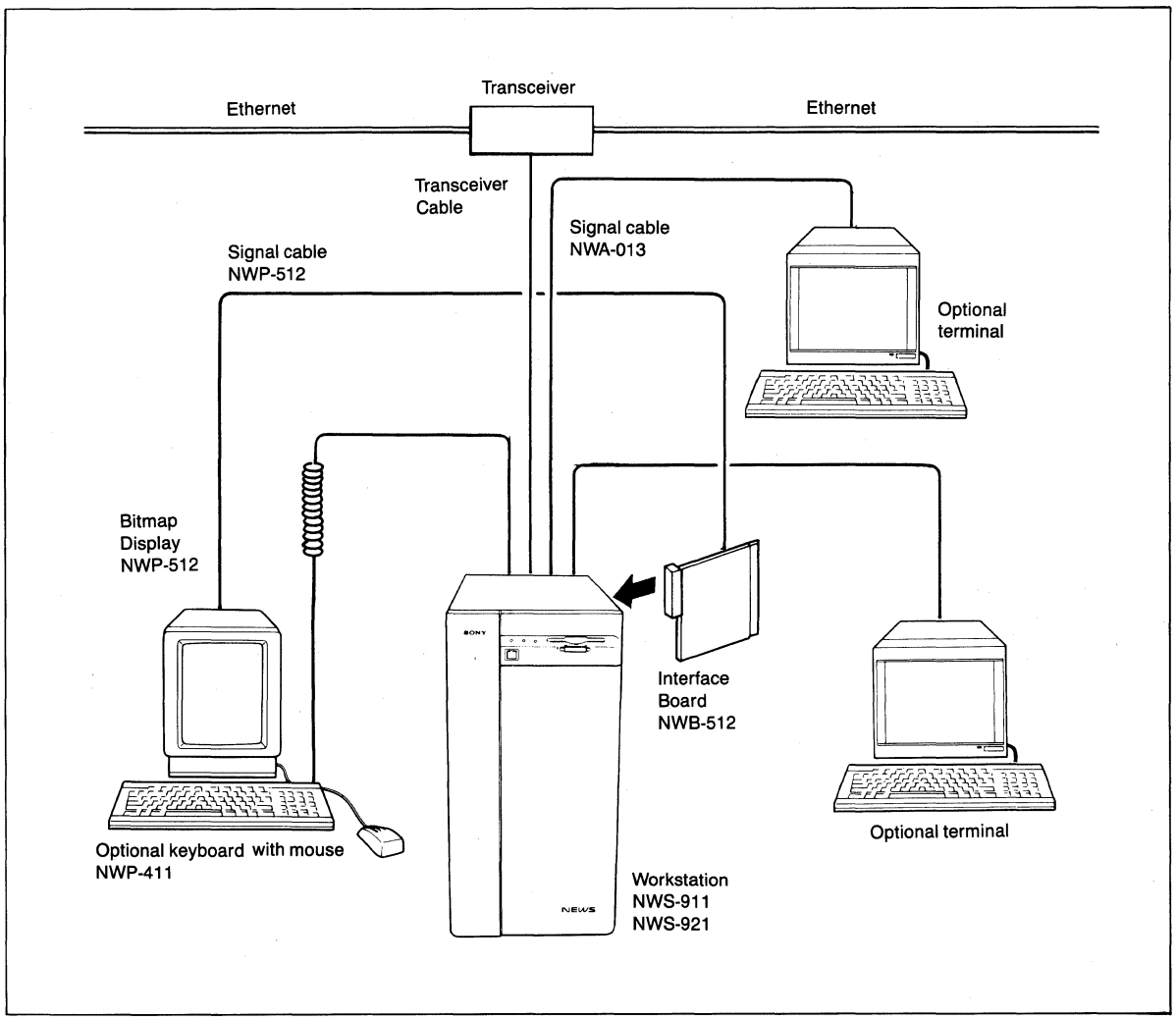
2. Comparison of NWS-911 and NWS-921

Model	Hard Disk Drive
NWS-911	286MB × 2
NWS-921	286MB × 4

3. Setting up the NEWS System

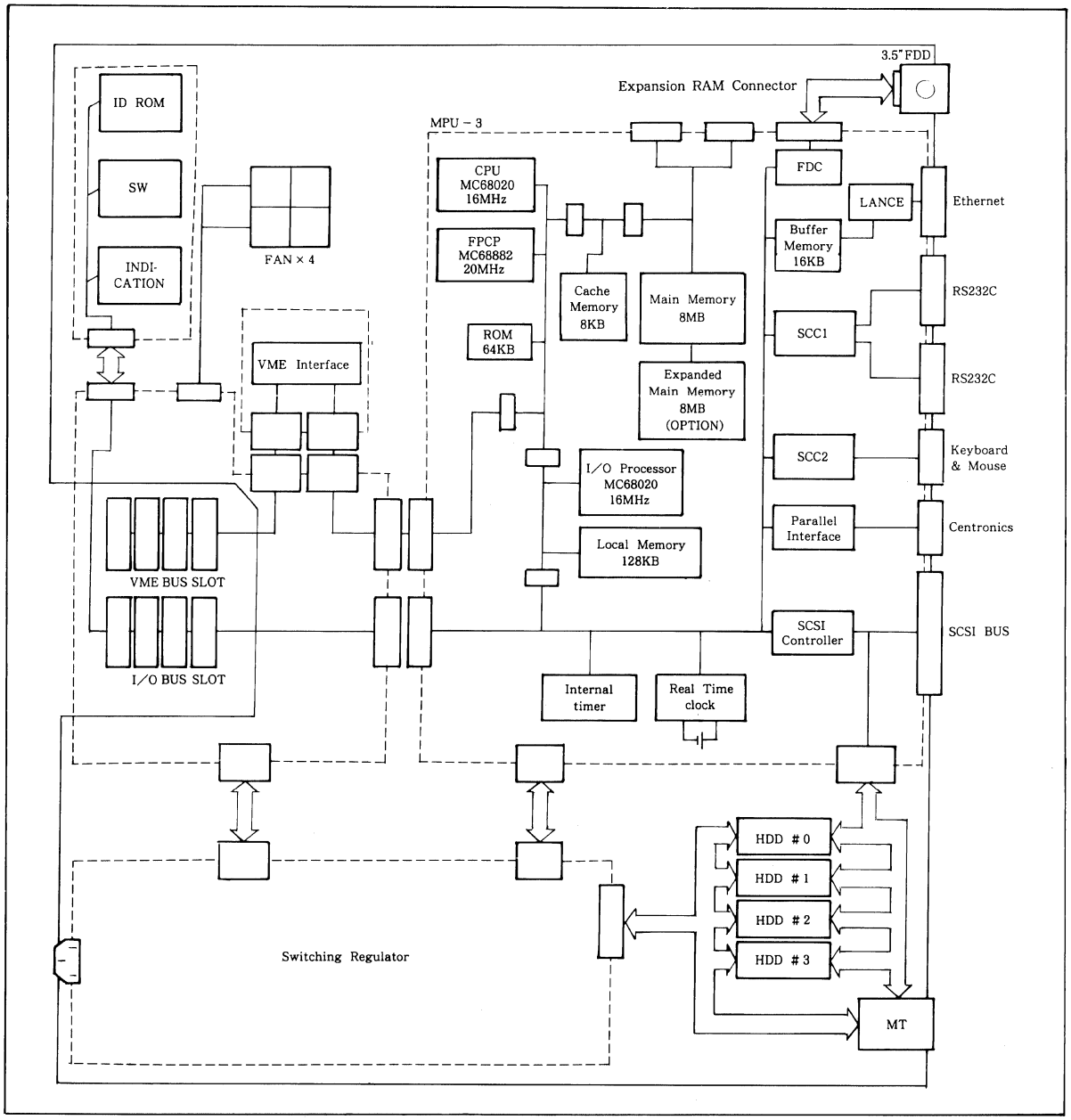
The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices.

The following diagram is an example of a multi-user system using two terminals and a bitmap display.

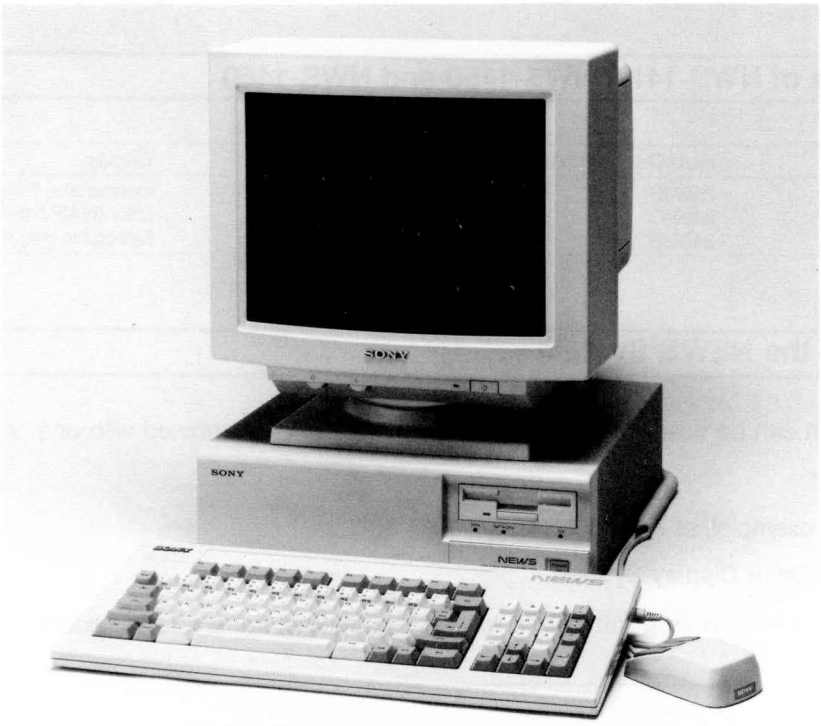


Note: A Double height VME Board Adapter Set (NWA-030) is required for installing the Double height VME board.

4. Block Diagram



Note: HDD Hard Disk Drive
FDD Floppy Disk Drive
FDC Floppy Disk Controller



NWS-1460

The NWS-1400 Series Network Station supports NEWS OS, and boasts a superb architecture employing a high-performance 25 MHz MC68030 32-bit microprocessor.

1. The NWS-1400 Series has these standard features:

- 25MHz MC68030 CPU
- 25MHz MC68882 floating-point coprocessor
- 3.9 MIPS system performance
- 8 Mbytes of main memory, expandable to a maximum of 16 Mbytes
- 1.44-Mbyte 3.5-inch floppy disk drive
- Large capacity hard disk drive
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in a keyboard/mouse interface
- Built-in Display interface (except NWS-1410)
  NWP-512D/NWP-518 for NWS-1450,
  NWP-515/NWP-519 for NWS-1460
- Selectable display for NWS-1410 (Interface Board is required)
- Built-in SCSI bus for external storage devices
- One expansion slot

(continued...)

- Smallest size Desktop Workstation
  size: 355W x 341D x 100H
  weight: 10kg (22 lb 1 oz.)

2. Comparison of NWS-1410, NWS-1450 and NWS-1460

Model	Hard Disk (formatted)	Software	Display
NWS-1450	240MB	NEWS-OS	monocrome (NWP-512D/NWP-518)
NWS-1460	240MB	NEWS-OS	color (NWP-515/NWP-519)
NWS-1410	240MB	NEWS-OS	Selectable (required Interface Board)

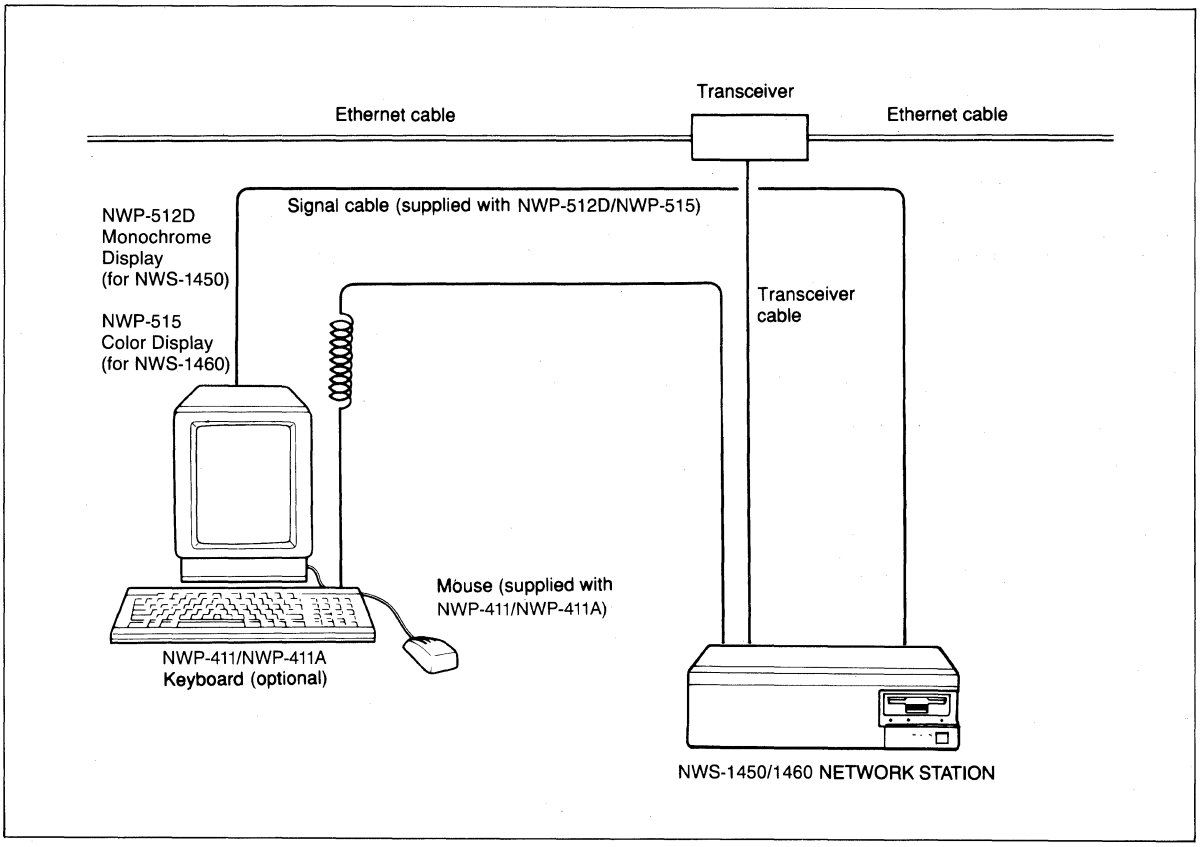
3. Setting up the NEWS System

The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices.

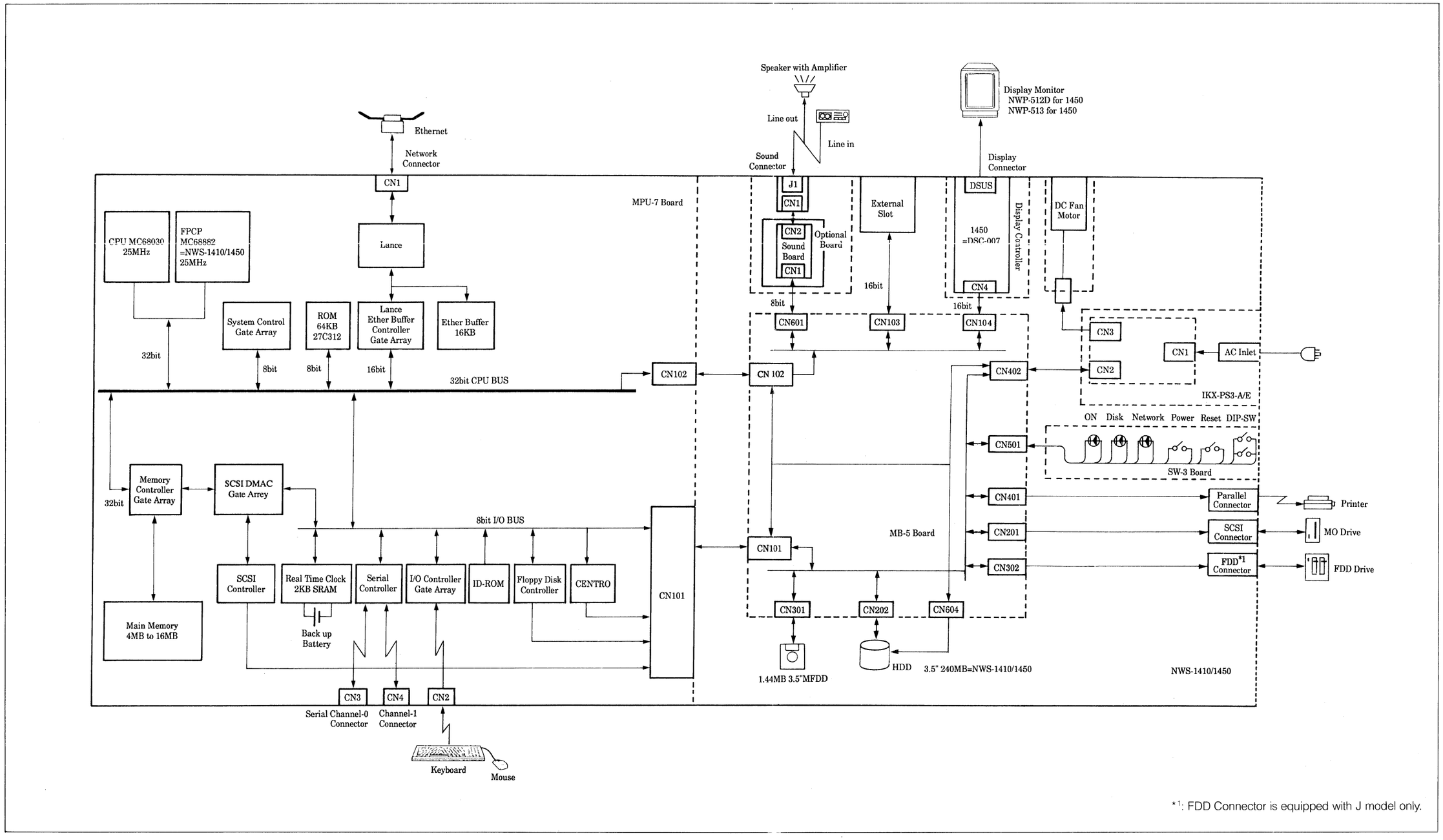
The following are examples of system configurations.

1) Monochrome/Color Display System

When using the workstation as a standalone system, no Ethernet transceiver is required.



4. Block Diagram



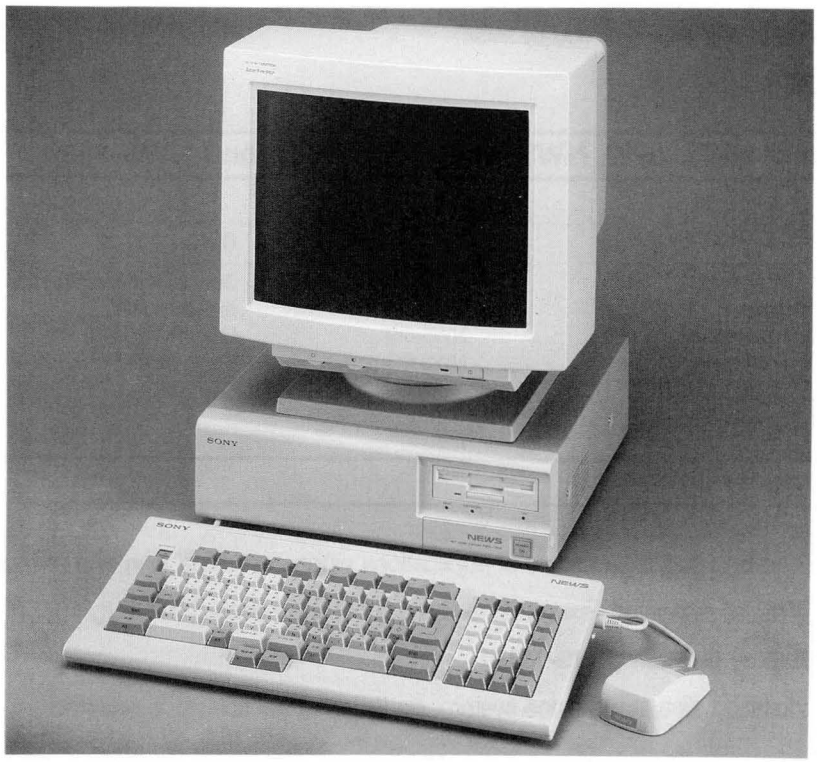
*1: FDD Connector is equipped with J model only.

1.5.5 NEWS 1500 Series

NWS-1510 PWS-1520
NWS-1520 PWS-1550
NWS-1530 PWS-1560
NWS-1580

1.5.5.1 NWS-1500 Series

NWS-1510 NWS-1530
NWS-1520 NWS-1580



NWS-1580

The NWS-1500 Series Network Station supports NEWS-OS. NWS-1500 Series boast a superb architecture employing a high-performance 25MHz MC68030 32-bit microprocessor.

1. The NWS-1500 Series has these standard features:

- 25MHz MC68030 CPU
- 25MHz MC68882 floating-point coprocessor
- 3.9 MIPS system performance
- 4 Mbytes of main memory, expandable to a maximum of 16 Mbytes
- 1.44-Mbyte 3.5-inch floppy disk drive
- Built-in Hard disk drive
  - 40 Mbytes: NWS-1510/1530
  - 170 Mbytes: NWS-1580
- Supports remote disk (NWS-1520)
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in a keyboard/mouse interface

(continued...)

- Built-in interface

  NWP-515 for NWS-1530/1580

  NWP-512D or NWE-501 for NWS-1520
- Built-in SCSI bus for external storage devices
- One expansion slot

Note: NWE-501 is an original product by SMSE.

2. Comparison of NWS-1510, NWS-1520, NWS-1530 and NWS-1580

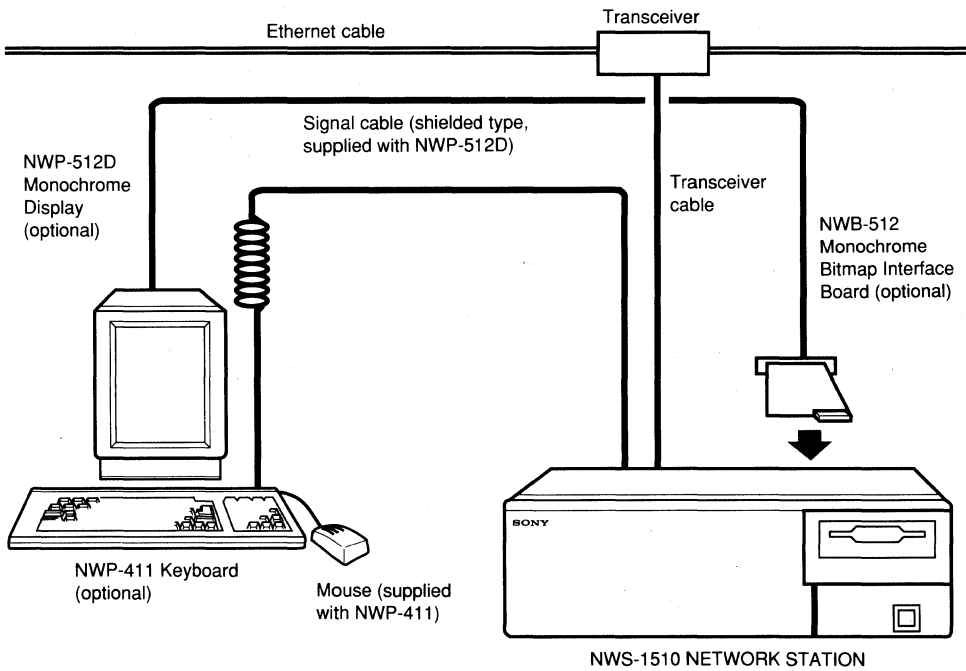
Model	Hard Disk (formatted)	Software	Display
NWS-1510	40 Mbytes	NWS-OS	Selectable (required Interface Board)
NWS-1520	none	NWS-OS	Monochrome
NWS-1530	40 Mbytes	NWS-OS	Color (NWP-515)
NWS-1580	170 Mbytes	NWS-OS	Color (NWP-515)

3. Setting Up the System

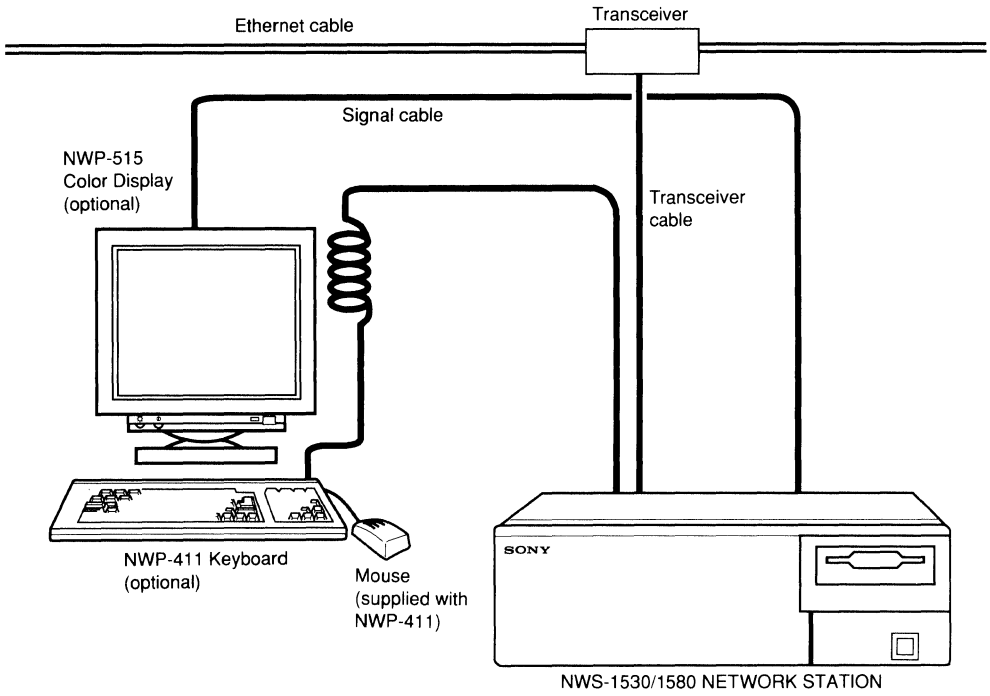
The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices. The followings are examples of system configurations.

1) Monochrome Display System (NWS-1510)

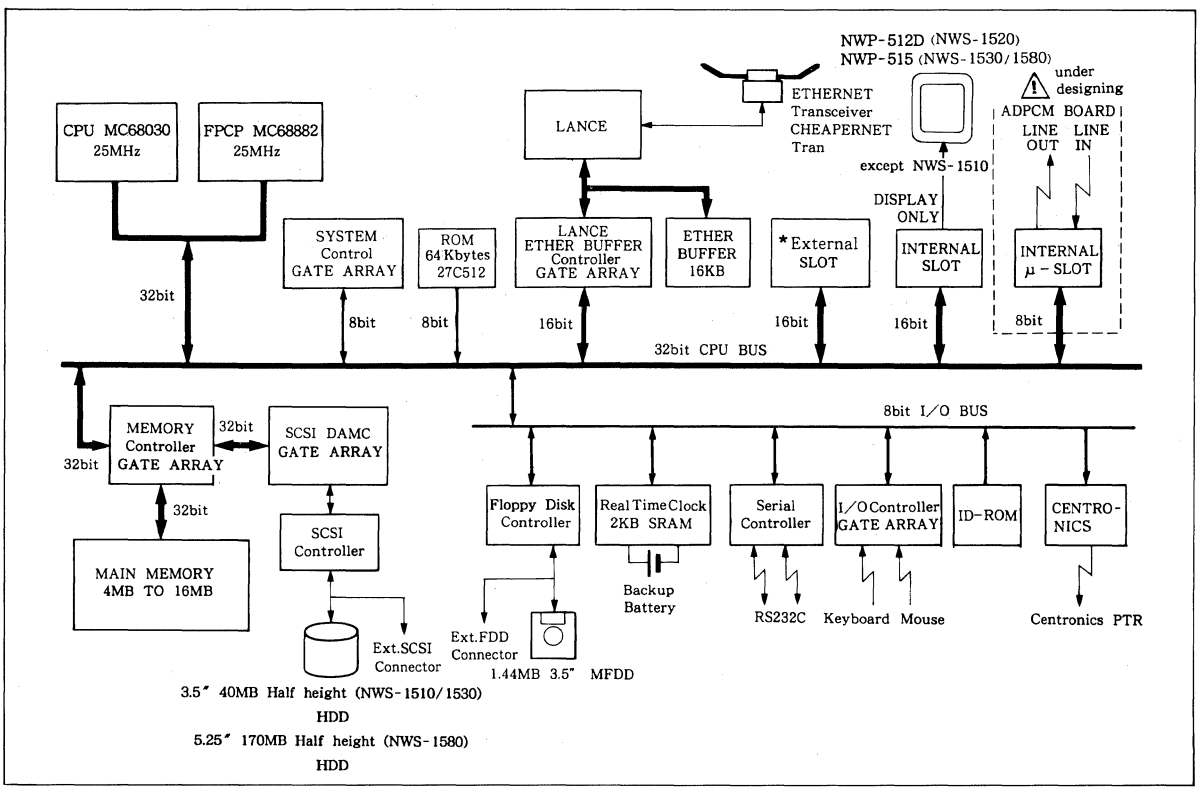
When using the workstation as a stand-alone system, no Ethernet transceiver is required.



2) Color Display System (NWS-1530/1580)



4. Block Diagram



Note: *Only supports the following expansion boards:

NWB-240A L.B.P./Image Reader Interface
NWB-241A L.B.P./Image Reader Interface
NWB-242 Image Board
NWB-243 Image Board
NWB-231A 4ch Serial Interface
NWB-235A Expansion Network Board
NWB-260 Audio Interface Board

1.5.5.2 PWS-1500 Series

PWS 1500 Series Network Station supports POP-OS for easy operations. PWS 1500 Series boast a superb architecture employing a high-performance 25MHz MC68030 32-bit microprocessor.

1. The PWS 1500 Series has these standard features:

- 25MHz MC68030 CPU
- 25MHz MC68881 floating-point coprocessor
- 3.9 MIPS system performance
- 4 Mbytes of main memory, expandable to a maximum of 16 Mbytes
- 1.44-Mbyte 3.5-inch floppy disk drive
- Built-in Hard disk drive
  - 40 Mbytes: PWS-1520
  - 91 Mbytes: PWS-1550/1560
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in a keyboard/mouse interface
- Built-in interface
  - NWP-512D for PWS-1520/1550
  - NWP-515 for PWS-1560
- Built-in SCSI bus for external storage devices
- One expansion slot

2. Comparison of PWS-1520, PWS-1550, and PWS-1560

Model	Hard Disk (formatted)	*Software	Display
PWS-1520	40 Mbytes	POP-OS	Monochrome
PWS-1550	91 Mbytes	POP-OS, Media Bank	Monochrome
PWS-1560	91 Mbytes	POS-OS, Media Bank	Color

Note: *It is possible to use NEWS-OS through the purchase of the "NEWS-OS Installation Kit (NWF-614A)" available on MO disk.

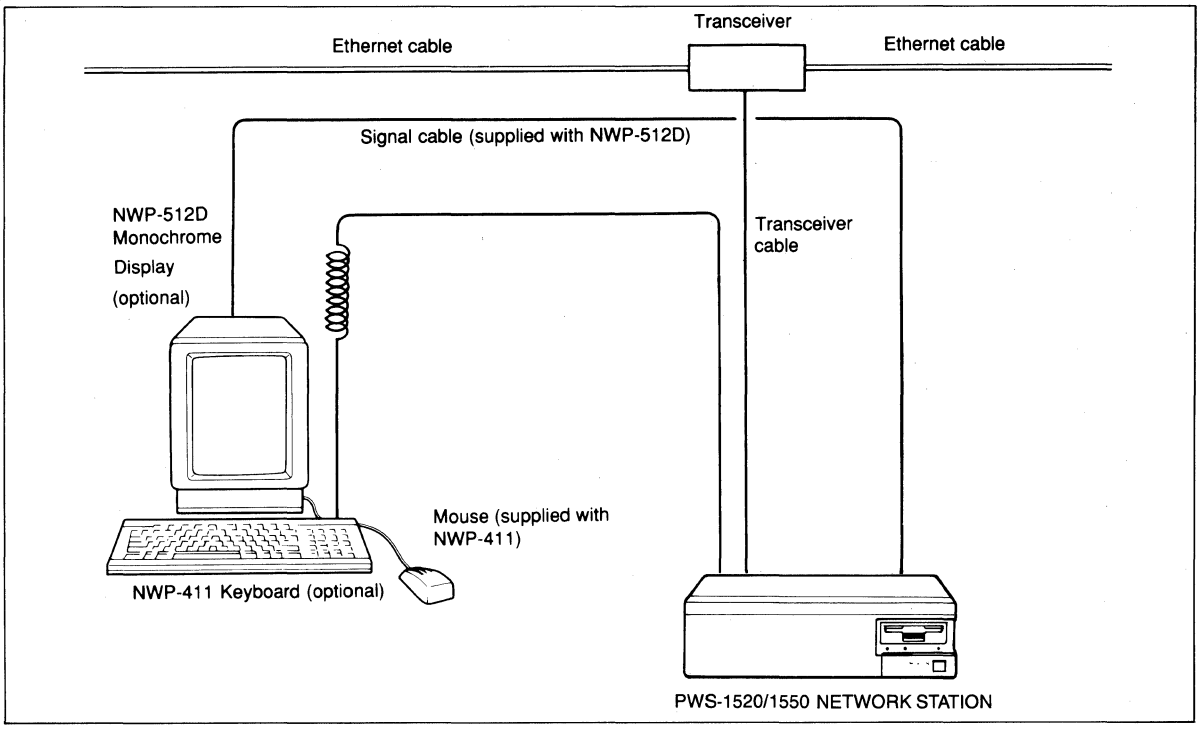
3. Setting Up the System

The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices.

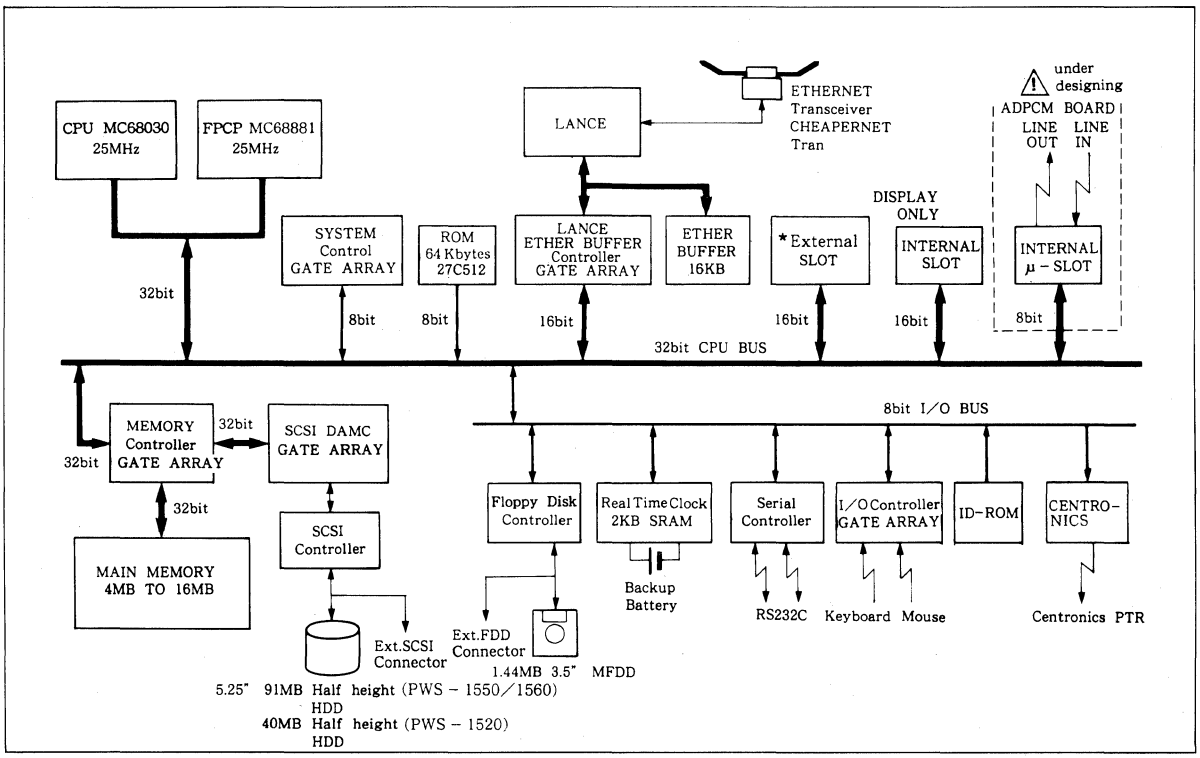
The followings are examples of system configurations.

1) Monochrome Display System (PWS-1520/1550)

When using the workstation as a stand-alone system, no Ethernet transceiver is required.



4. Block Diagram



Note: *Only supports the following expansion boards:

NWB-240A	L.B.P./Image Reader Interface
NWB-241A	L.B.P./Image Reader Interface
NWB-242	Image Board
NWB-243	Image Board
NWB-231A	4ch Serial Interface
NWB-235A	Expansion Network Board
NWB-260	Audio Interface Board

PWS-1630

The incorporation of the latest 32-bit microprocessor MC68030 and a high-speed cache memory makes the NWS-1600 Series a powerful 4.3 MIPS machine.

1. The NWS-1600 Series has these standard features:

- 25MHz MC68030 CPU
- 4.3 MIPS system performance
- 25MHz MC68882 floating-point coprocessor
- 4 Mbytes of main memory. Expandable to a maximum of 32 Mbytes*
- 16-Kbyte cache memory
- 170-Mbyte hard disk drive
- 1.44-Mbyte 3.5-inch floppy disk drive
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in SCSI bus for external storage devices
- Three expansion slots

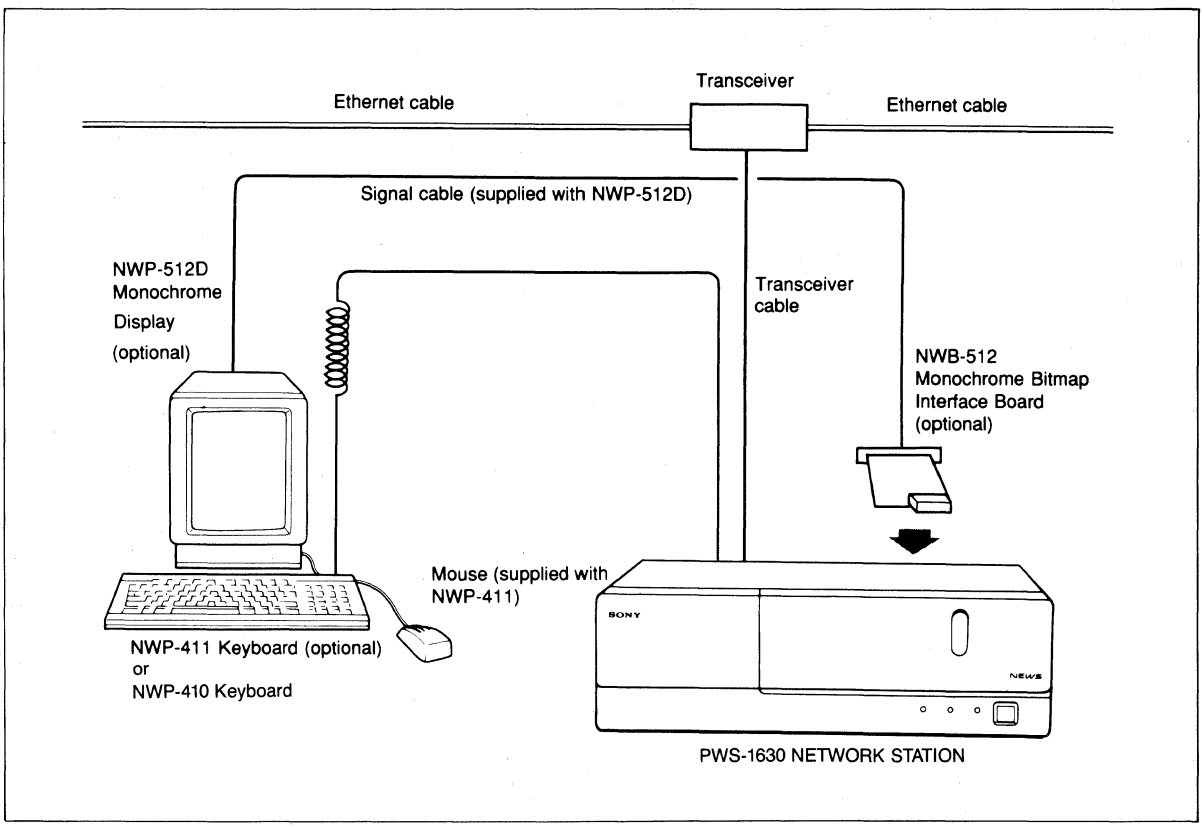
Note: *Memory Expansion: 4MB with each NWA-029 For expansion over 16MB, NWB-110 is necessary.

2. Setting up the NEWS System

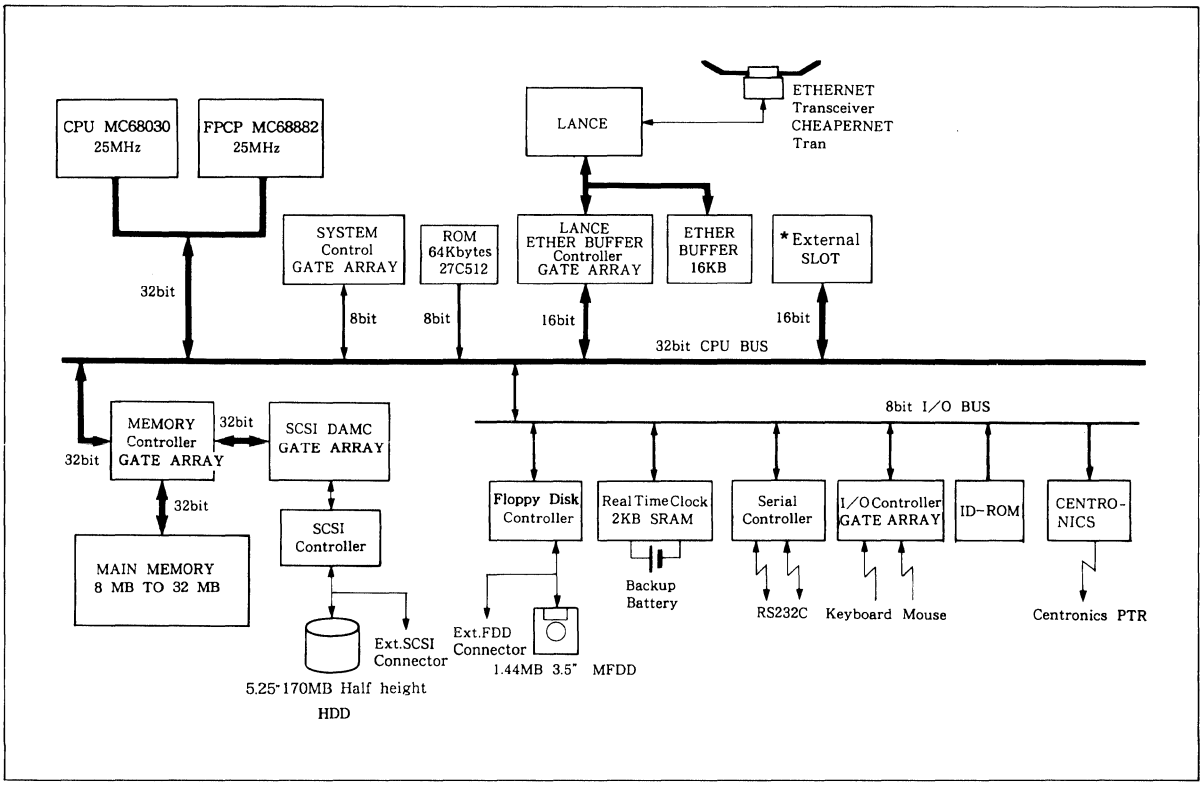
The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices. The following are examples of system configurations.

1) Monochrome Display System

When using the workstation as a stand-alone system, no Ethernet transceiver is required.



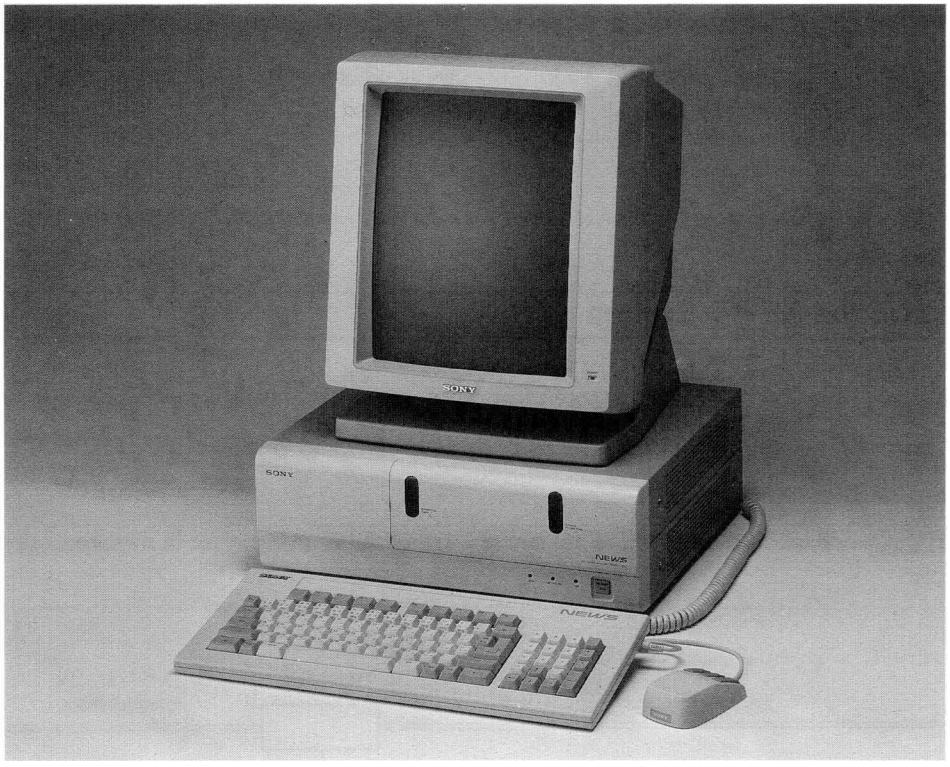
3. Block Diagram



Note: *3 slots available

Only supports the following expansion boards:

NWB-240A	L.B.P./Image Reader Interface
NWB-241A	L.B.P./Image Reader Interface
NWB-242	Image Board
NWB-243	Image Board
NWB-231	4ch Serial Interface
NWB-235A	Expansion Network
NWB-260	Audio Interface Board



NWS-1750

The incorporation of the latest 32-bit microprocessor MC68030 and a high-speed cache memory makes the NWS-1700 Series a powerful 4.3 MIPS machine.

1. The NWS-1700 Series has these standard features:

- 25MHz MC68030 CPU
- 4.3 MIPS system performance
- 25MHz MC68882 floating-point coprocessor
- Main memory expandable to a maximum of 32 Mbytes
- 16-Kbyte cache memory
- Large capacity internal hard disk drive
- 1.44-Mbyte 3.5-inch floppy disk drive
- 125-Mbyte streaming tape drive (NWS-1750 only)
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in SCSI bus for external storage devices
- Three expansion slots

2. Comparison of NWS-1710, NWS-1720 and NWS-1750

The specifications which distinguish the NWS-1710, the NWS-1720 and the NWS-1750 are as follows:

Model	Main Memory	Streaming Tape Drive	HDD Formatted
NWS-1710	4MB expandable to 32MB	Not included	None
NWS-1720	4MB expandable to 32MB	Not included	156MB
NWS-1750	4MB expandable to 32MB*(UC)	125MB	286MB
	8MB expandable to 32MB*(EK, J)		

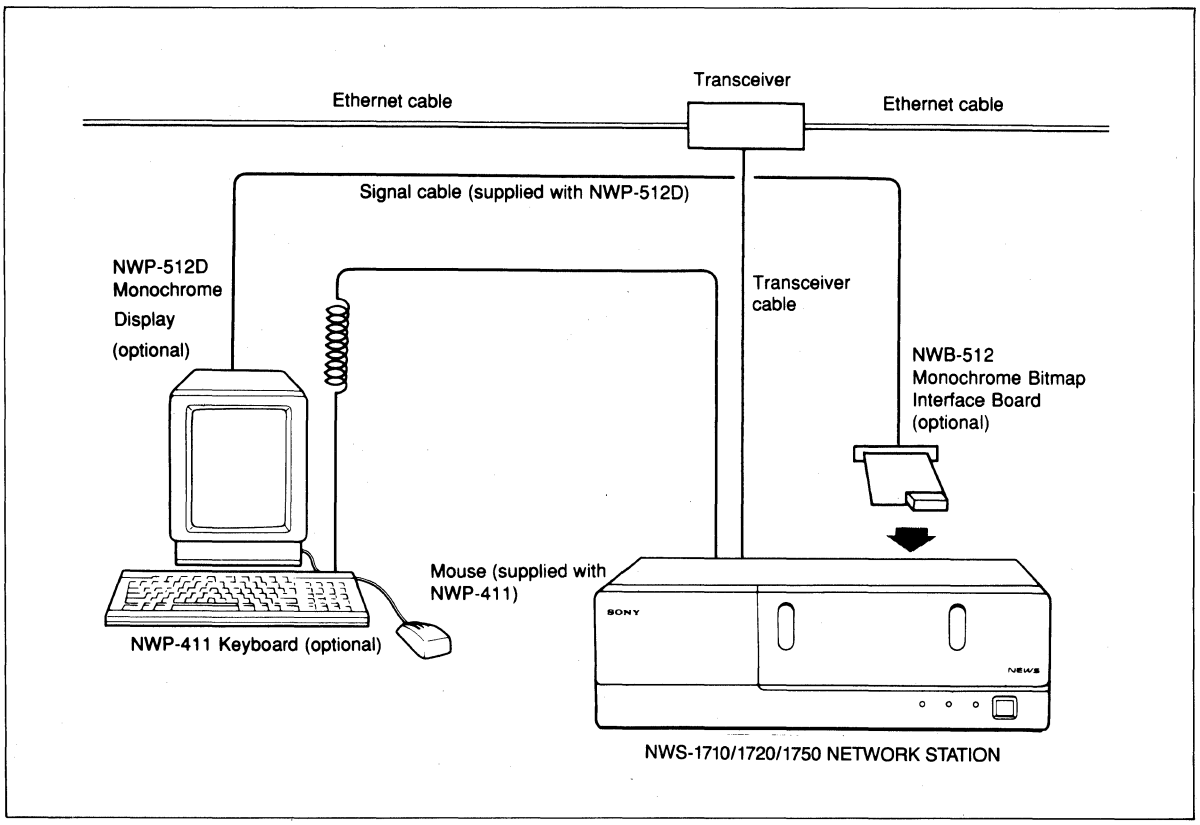
*Memory Expansion: 4MB with each NWA-029. For expansion over 16MB, NWB-110 is necessary.

3. Setting up the NEWS System

The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices. The following are examples of system configurations.

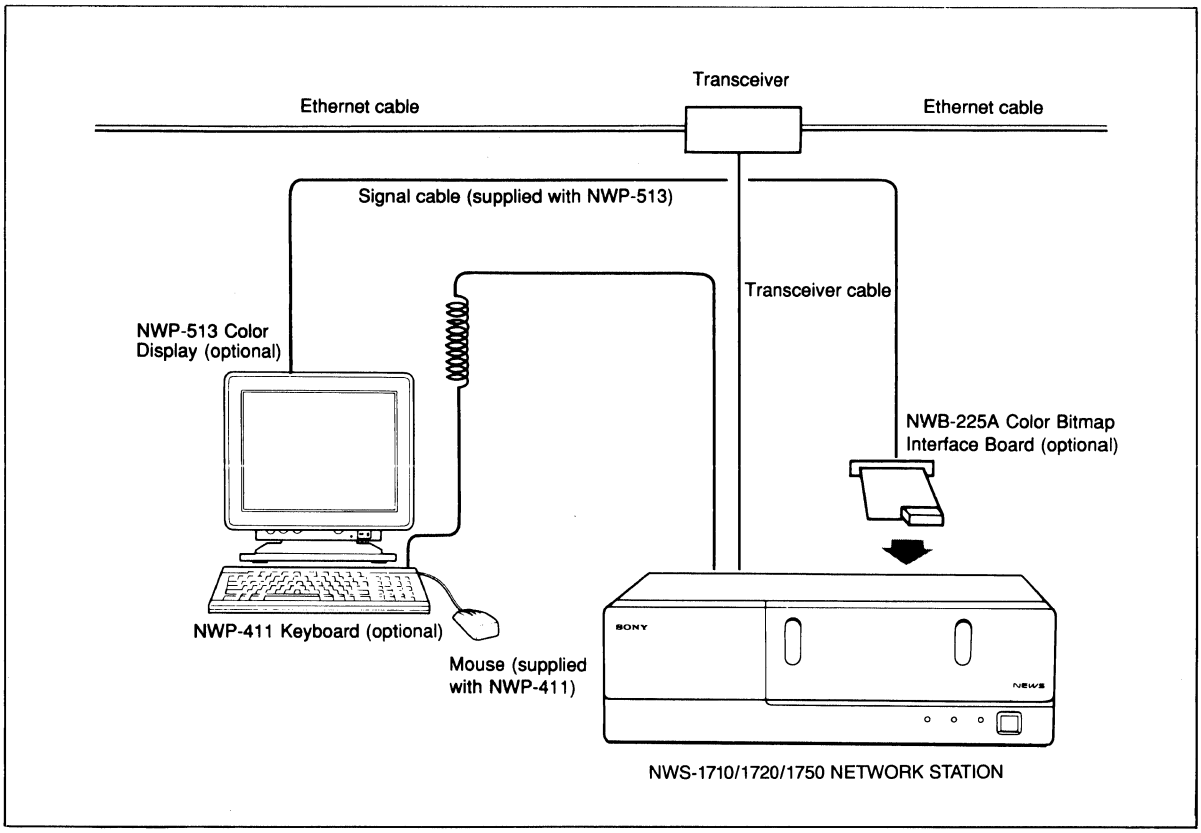
1) Monochrome Display System

When using the workstation as a stand-alone system, no Ethernet transceiver is required.

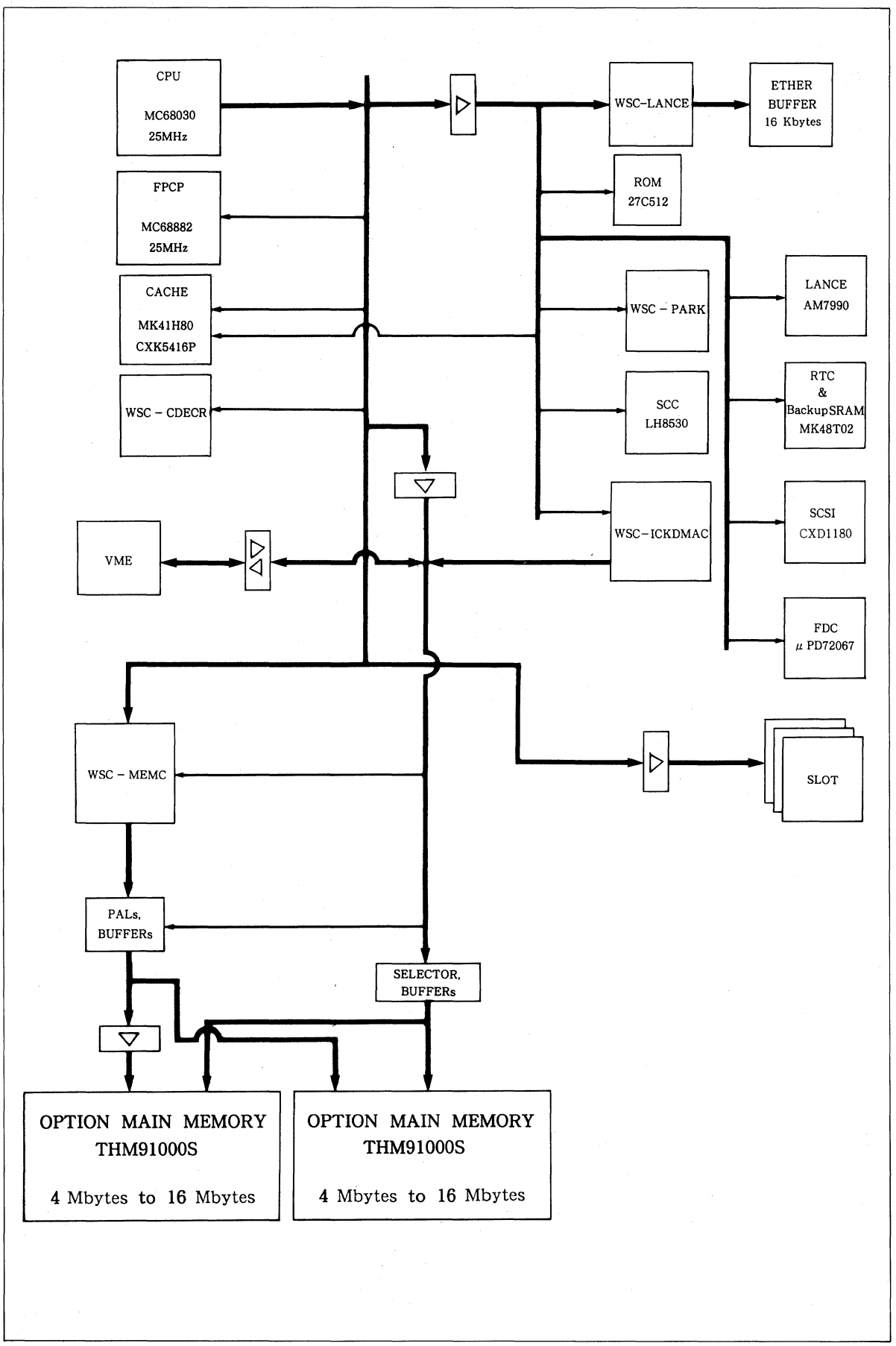


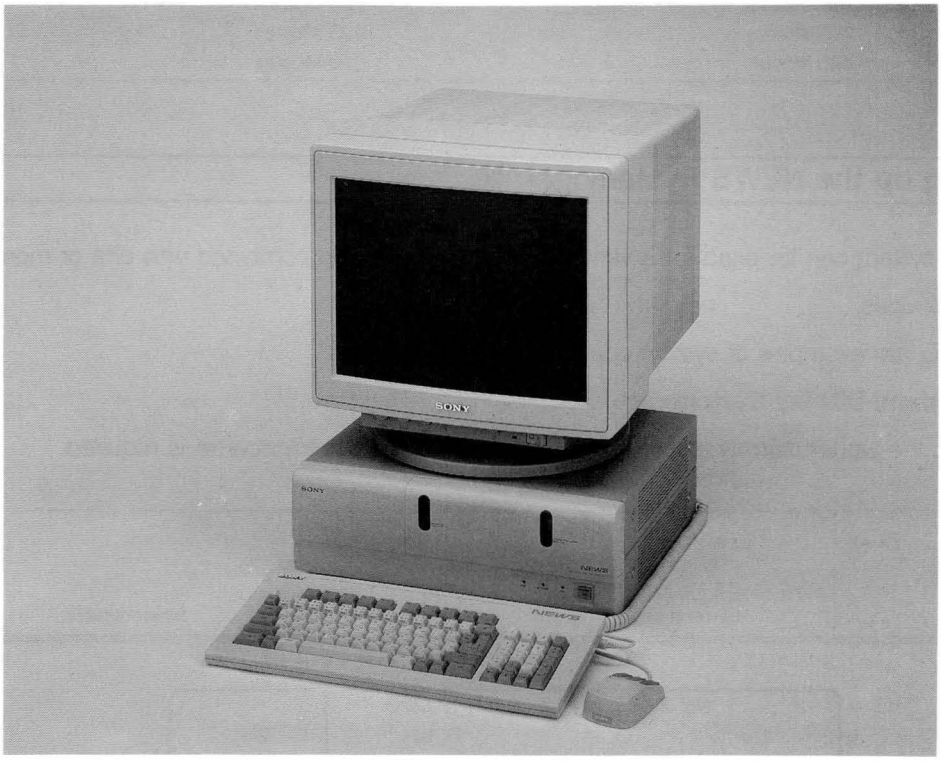
Note: (UC) indicates US/Canadian specifications
(EK) indicates European specifications
(J) indicates Japanese specifications

2) Color Display System



4. Block Diagram





NWS-1850

The NWS-1800 Series is in keeping with the NWS-800 Series design concept.
It offers processing capabilities exceeding those of even the NWS-800 Series.

1. The NWS-1800 Series has these standard features:

- Dual-processor architecture using two 25MHz MC68030s
- 5.3 MIPS system performance
- 25MHz MC68882 floating-point coprocessor
- 16-Mbyte main memory (expandable up to 32 Mbytes)
- 64-Kbyte cache memory
- Incorporates a large capacity hard disk drive
- Incorporates a 1.44-Mbyte 3.5-inch floppy disk drive
- Incorporates 125-Mbyte streaming tape drive (NWS-1850) and 150-Mbyte streaming tape drive (NWS-1860)
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in a keyboard/mouse interface
- Built-in SCSI bus for external storage devices
- Three expansion slots

2. Comparison of NWS-1830, NWS-1850 and NWS-1860

Model	Hard disk (formatted)	Streaming tape drive
NWS-1830	156 Mbytes	Not included
NWS-1850	286 Mbytes	125 Mbytes
NWS-1860	640 Mbytes	150 Mbytes

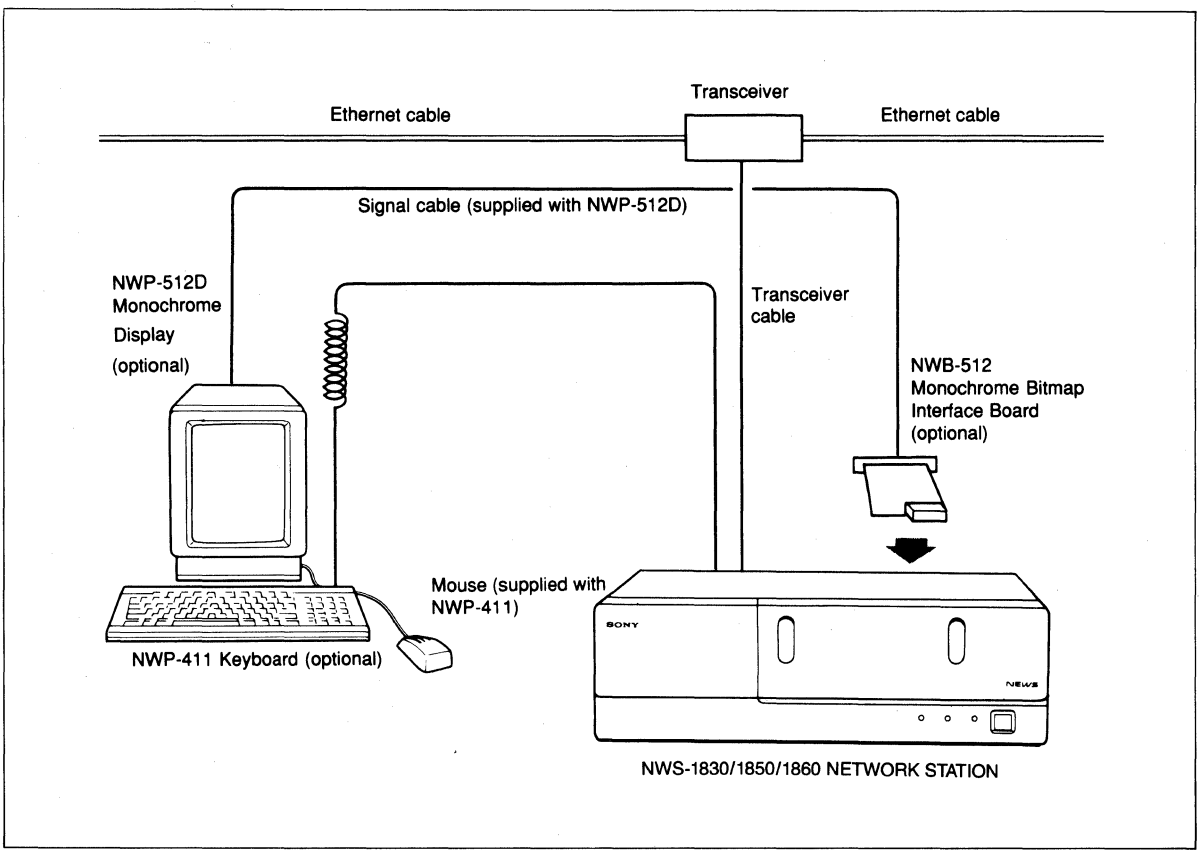
3. Setting up the NEWS System

The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices.

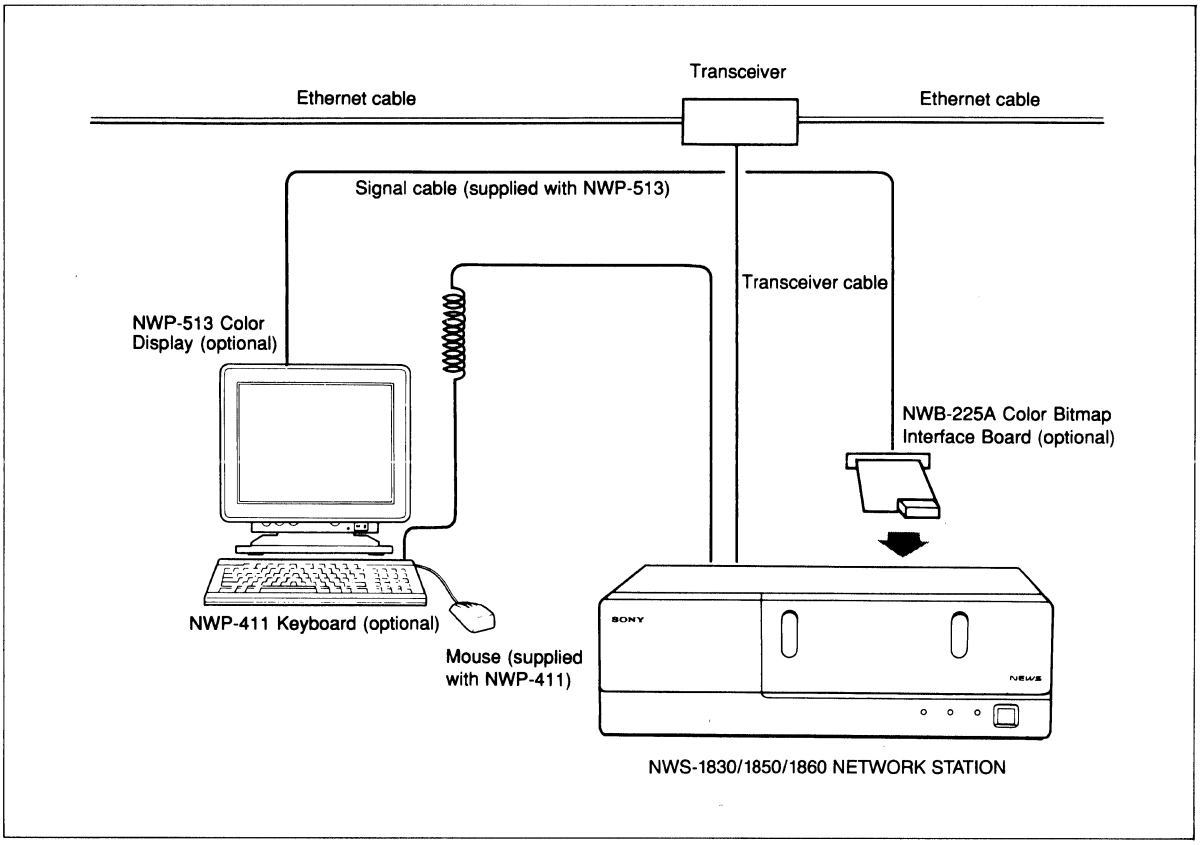
The following are examples of system configurations.

1) Monochrome Display System

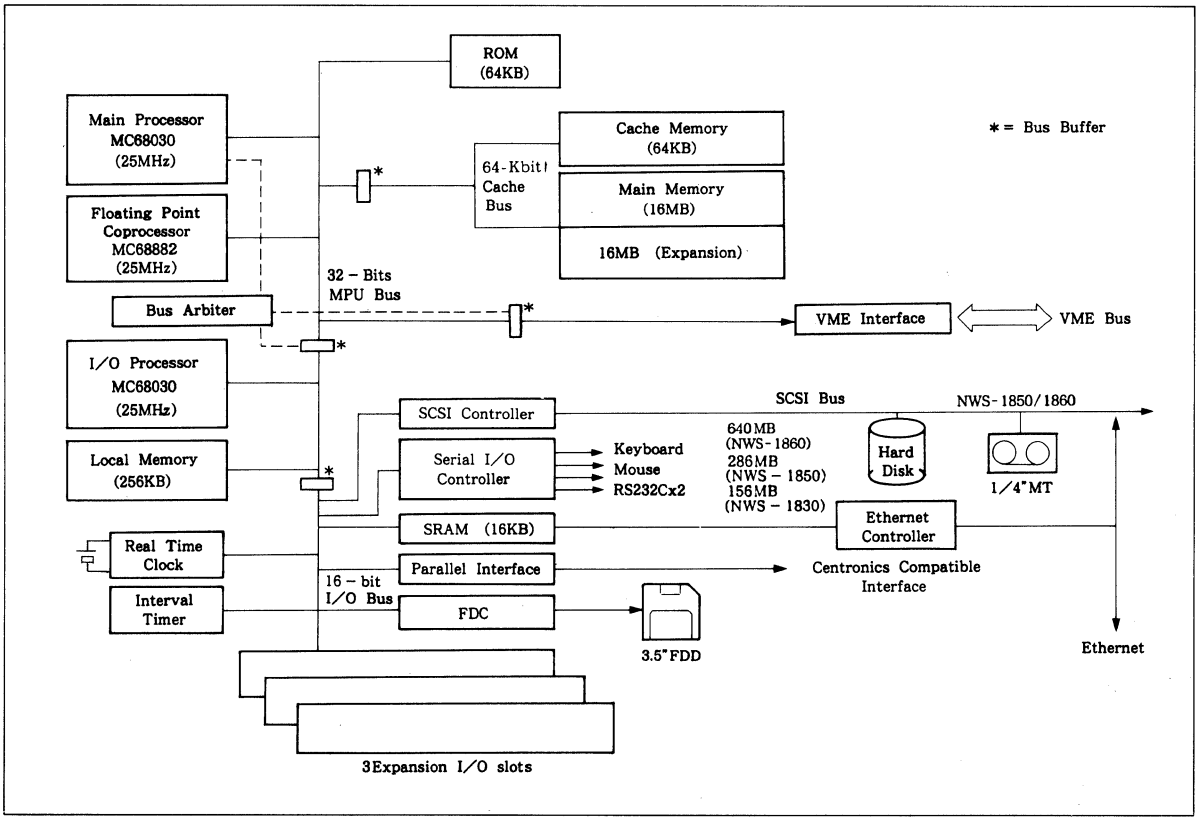
When using the workstation as a stand-alone system, no Ethernet transceiver is required.

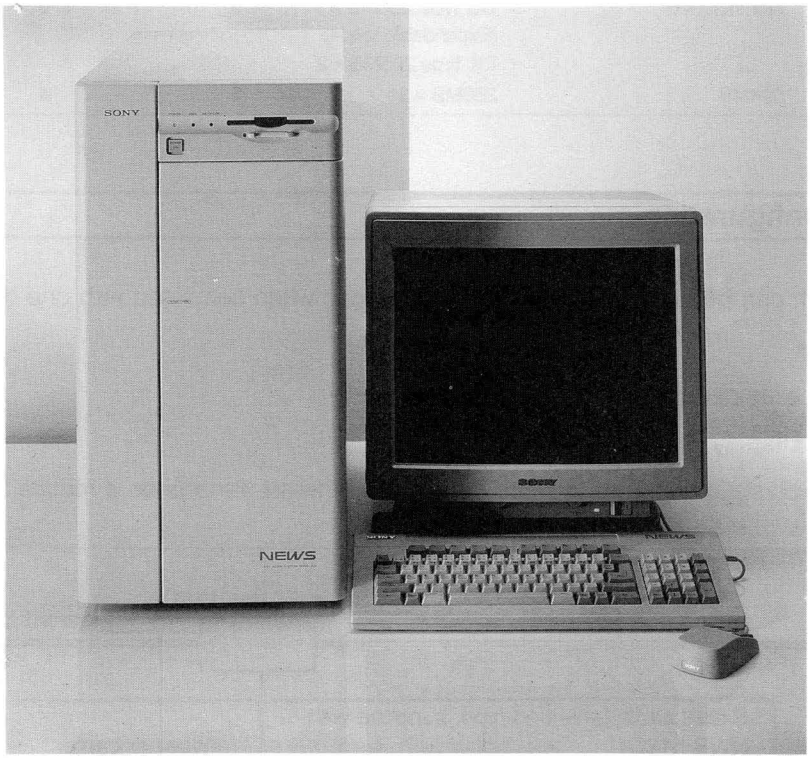


2) Color Display System



4. Block Diagram





NWS-1930

The NWS-1900 Series realizes system performance of 5.3 MIPS and features dual processor architecture using two MC68030s, one as a main processor and the other as a specialized I/O processor. It also offers increased expandability with the incorporation of VME bus architecture.

1. The NWS-1900 Series has these standard features:

- Dual-processor architecture using two 25MHz MC68030s
- 5.3 MIPS system performance
- 25MHz MC68882 floating-point coprocessor
- 16-Mbyte main memory (expandable up to 32 Mbytes)
- 64-Kbyte cache memory
- 125-Mbyte streaming tape drive
- Large capacity internal hard disk drive
- Built-in Ethernet controller
- Built-in two-channel RS-232C serial port
- Built-in parallel port for printer connection
- Built-in SCSI bus for external storage devices
- VME bus architecture
- NWS-1960 is equipped with MO drive

2. Comparison of NWS-1930 and NWS-1960

Model	Magneto Optical Disk Drive	HDD (formatted)	Expansion Slots	VME Slots
NWS-1930	Not included	UC type 286MB × 1 (Expandable to × 4) EK type 286MB × 2	3	5
NWS-1960	594MB	286MB × 3	4	4

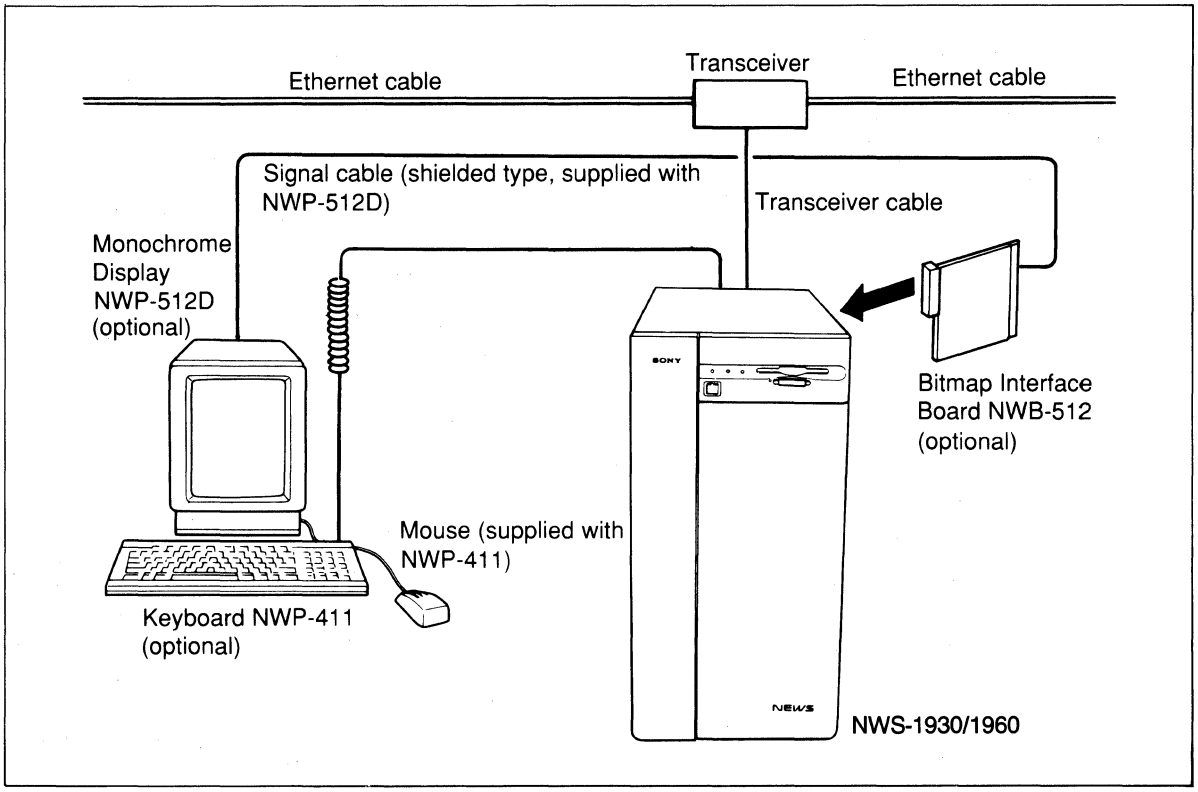
3. System Configuration

The NEWS system can be used for a variety of applications when combined with one or more available peripheral devices.

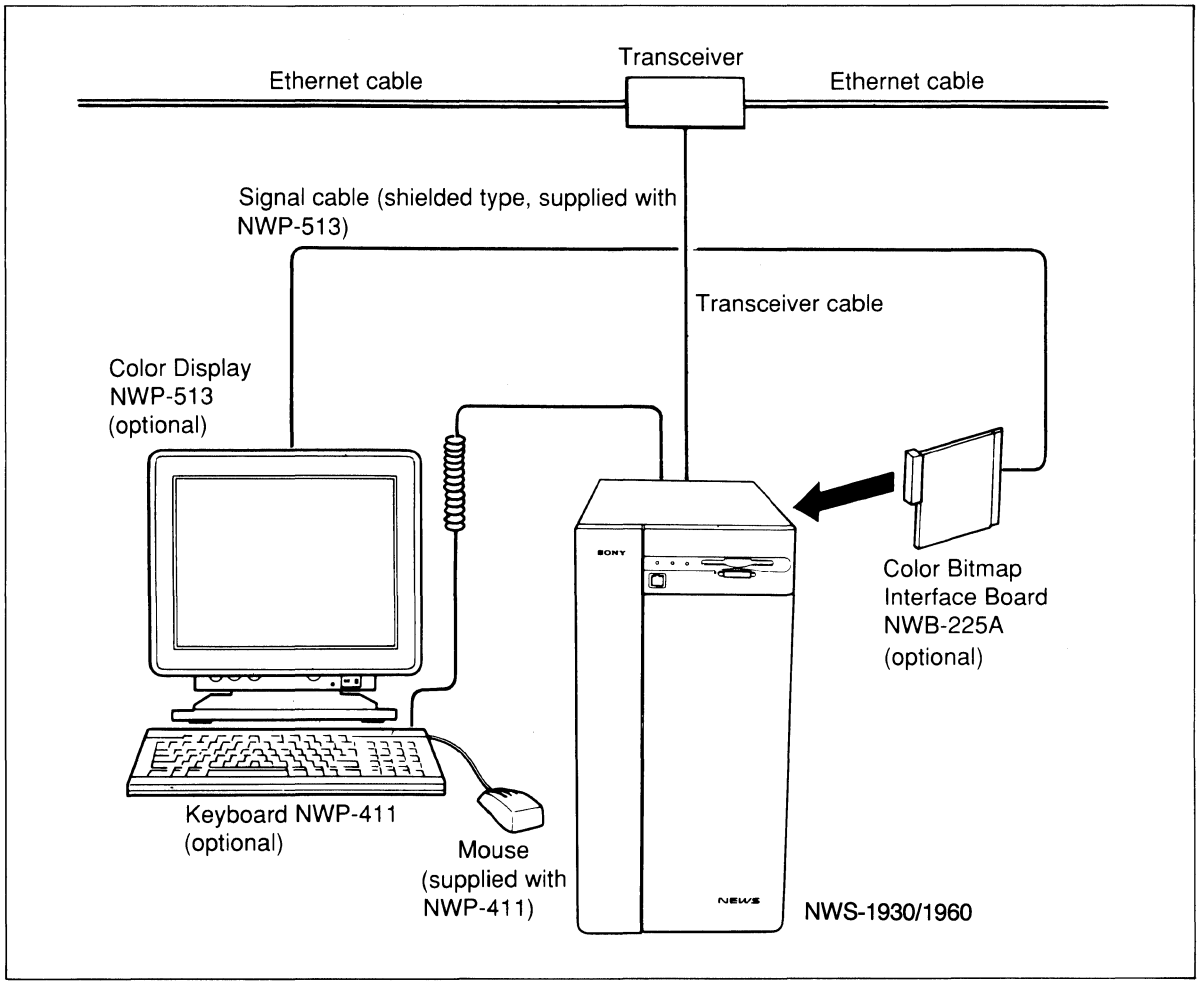
The following are examples of system configurations.

1) Monochrome Display System

When using the workstation as a stand-alone system, no Ethernet transceiver is required.

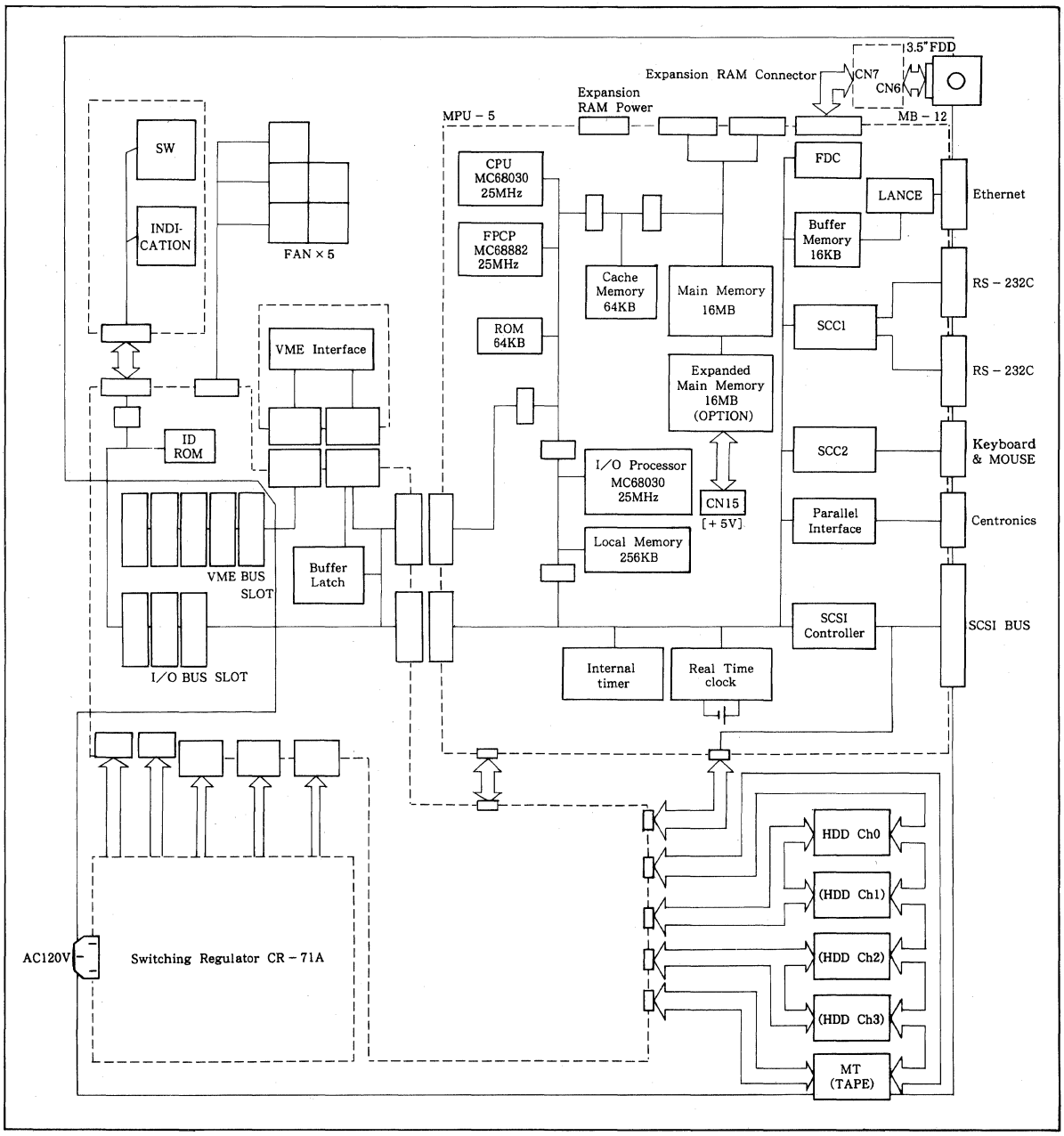


2) Color Display System



Note: VME board size
NWS-1930: SUN VME bus Card
NWS-1960: Triple height Eurocard

4. Block Diagram [NWS-1930 (UC)]



NWS-1250

Despite its compactness, it offers full UNIX BSD capabilities. The NWS-1200 Series employs the MC68030 CPU and the MC68882 floating-point coprocessor, both operation at 25 MHz, and can perform 3.9 MIPS processing power.

1. The NWS-1200 Series has these standard features:

- 25MHz MC 68030 CPU.
- 25MHz MC68882 floating-point coprocessor.
- 3.9 MIPS system performance.
- 4MB (for NWS-1230) or 8MB (for NWS-1250) of main memory. Both expandable to 12MB.
- 1.44MB (formatted) 3.5-inch floppy disk drive.
- Built-in Hard disk drive. 200MB (formatted) for NWS-1230 and 240MB (formatted) for NWS-1250.
- High resolution (1120 × 780 pixels), large and back-lit LCD display.
- Built-in Ethernet controller.
- Built-in RS-232C Serial Port.
- Built-in parallel port for printer connection.
- Built-in mouce interface.
- Built-in SCSI bus for external storage devices.
- One expansion slot for modem.
- Built-in Audio Interface.

2. Comparison of NWS-1230 and NWS-1250

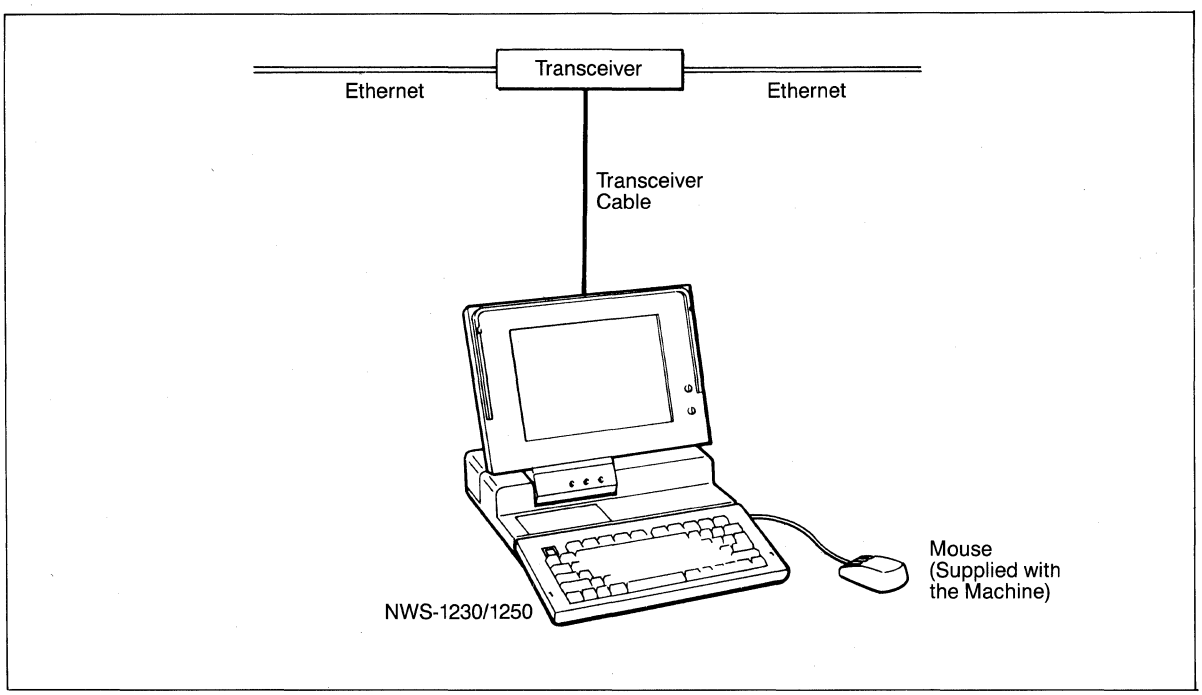
MODEL	Main Memory	Hard Disk (formatted)
NWS-1230	4MB	200MB
NWS-1250	8MB	240MB

3. Sample Configurations

The NWS-1200 Series can be used for a variety of applications when combined with available peripherals. Followings are a few example system configurations:

1) Standard System (Connecting to Ethernet Transceiver)

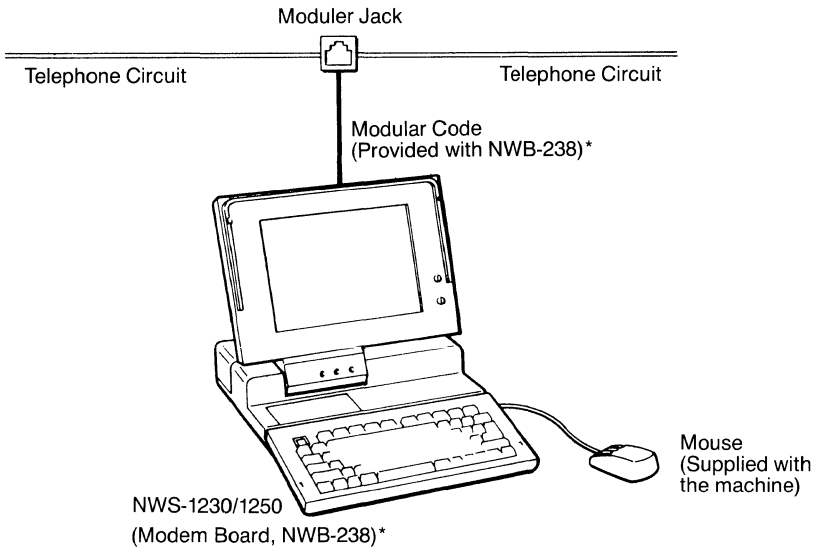
Just connecting optional Ethernet Transceiver (NWA-021 or NWA-022), UNIX Net Working environment can be realized.



When using the workstation as a stand-alone system, no Ethernet transceiver is required.

2) Using Modem

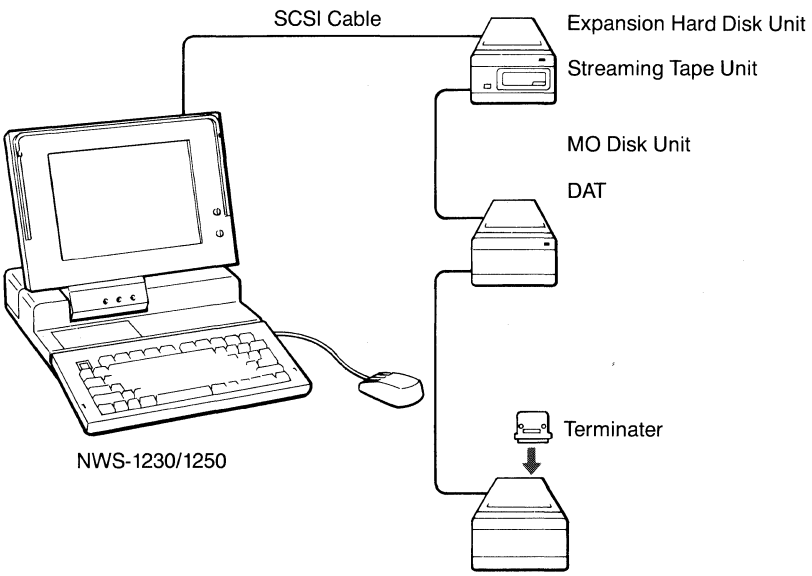
Using an optional modem board (NWB-238*), communication with a telephone circuit can be realized.



*NWB-238 is designed based on the Japanest telecommunication standard and can be used only in Japan.

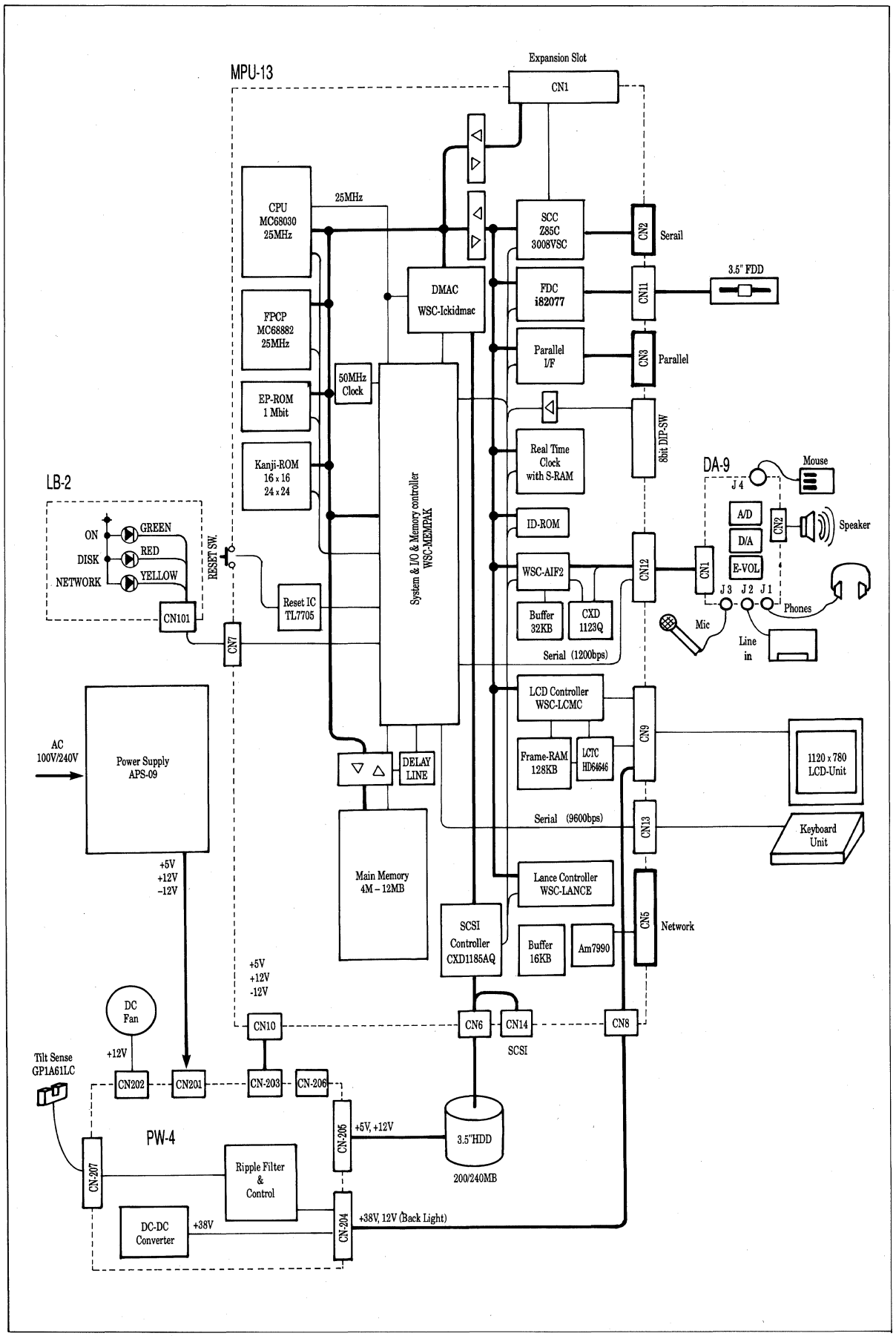
3) Connection to Expansion Hard Disk Unit

In addition to a built-in Hard Disk Unit, up to 6 units of External Storage Units such as Hard Disk Unit, MO Disk Drive Unit, DAT Data Storage Unit, or up to 4 units of Streaming Tape Unit can be connected.



*Connection between the NWS-1250 and the first storage device must be done via the PCZ-310T SCSI cable.

4. Block Diagram



NWS-3200

Based on a powerful RISC (Reduced Instruction Set Computer) architecture CPU, the 3200 Series workstations deliver 17 MIPS of CPU processing power and 1.8 MFLOPS double-precision floating-point arithmetic computations.

1. The NWS-3200 Series has these standard features:

- 20MHz R3000 CPU.
- 20MHz R3010 floating-point accelerator.
- 17MIPS system performance.
- 1.8MFLOPS double precision floting-point arithmetic computations.
- 8MB of main memory, expandable to 24 MB*1 (UC model).
  16MB of main memory, expandable to 48MB (EK and J model).
- 1.44MB (formatted) 3.5 inch floppy disk drive.
- Built-in Hard Disk Drive:
  240MB (formatted) for NWS-3250 (UC), Type D.
  406MB (formatted) for NWS-3250 (UC), Type F and NWS-3260 (EK and J).
- Built-in Ethernet Controller.
- Built-in RS-232C serial port.
- Built-in Parallel port for printer connection. (NWA-056, Printer Cable is required.)

*1: Main memory of NWS-3250 can be expanded up to 36MB if you replace the initial 4MB memory modules with 16MB ones.

(continued...)

- Built-in mouse interface.
- Built-in SCSI bus (half pitch) for external storage devices.
- Built-in Audio Interface.
- One expansion slot.

2. Comparison of NWS-3250 (Type D), NWS-3250 (Type F) and NWS-3260

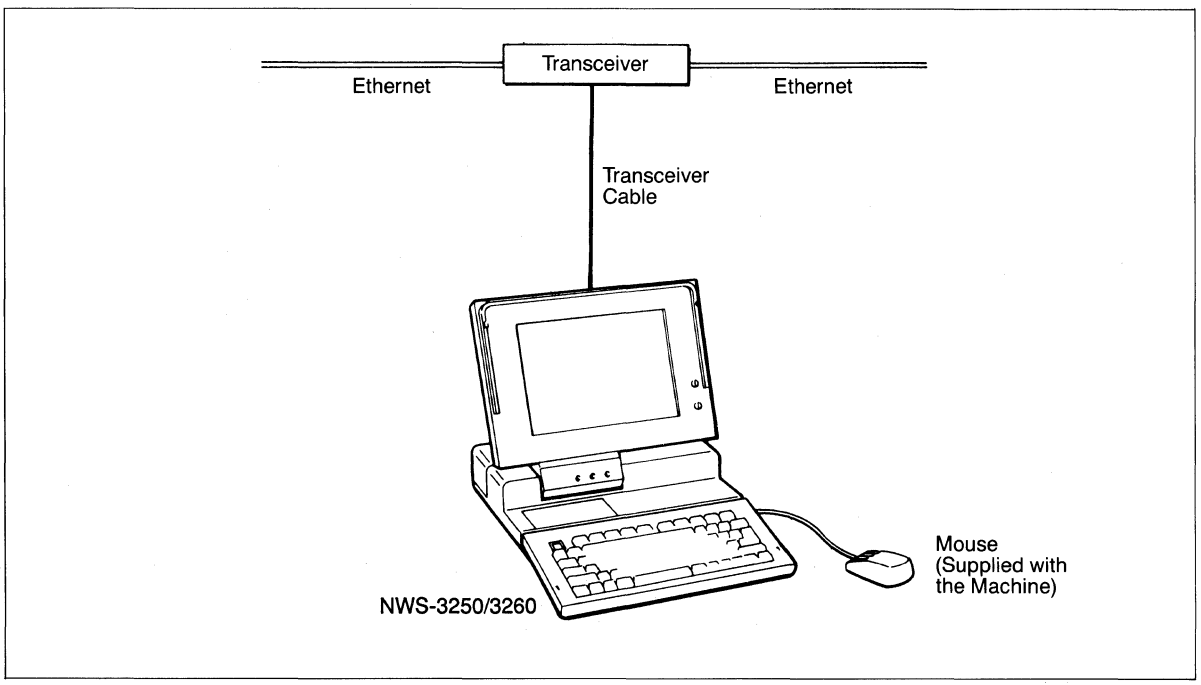
MODEL	Main Memory	Hard Disk (formatted)
NWS-3250 (UC), Type D	8MB	240MB
NWS-3250 (UC), Type F	8MB	406MB
NWS-3260 (EK and J)	16MB	406MB

3. Sample Configurations

The NEWS 3200 Series can be used for a variety of applications when combined with available peripherals. Followings are some sample configurations:

1) Standard System (Connecting to Ethernet Transceiver)

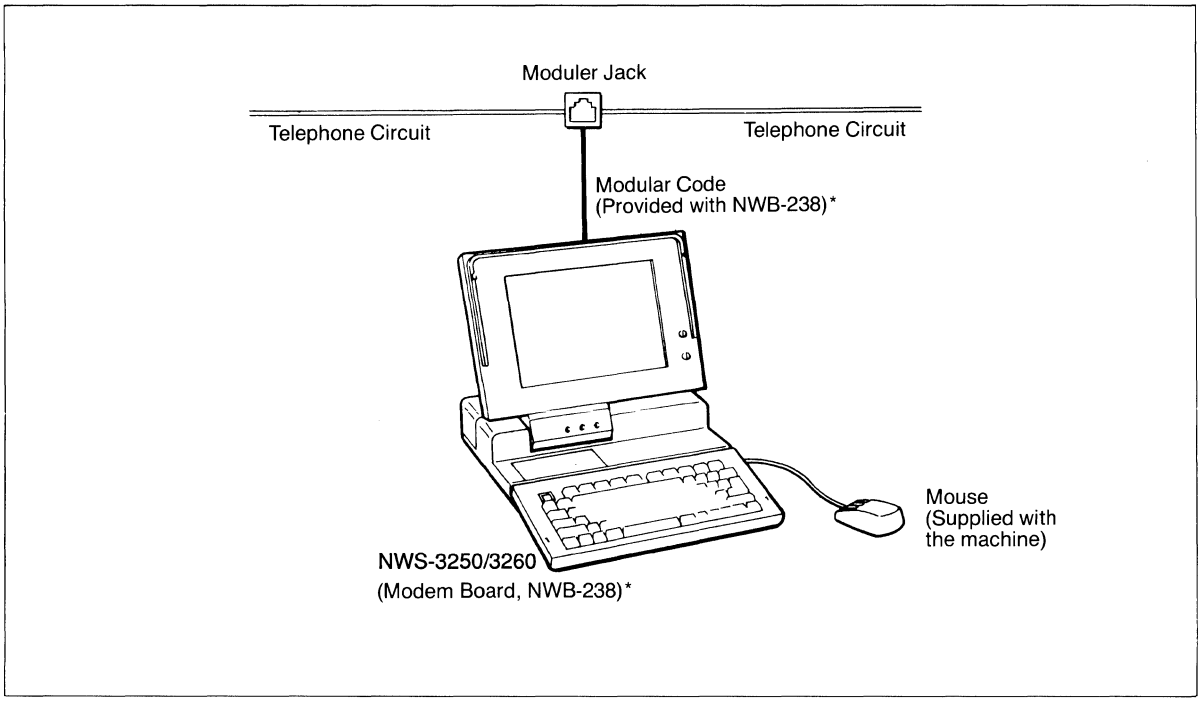
Just connecting optional Ethernet Transceiver (NWA-021 or NWA-022), UNIX Net Working environment can be realized.



When using the workstation as a stand-alone system, no Ethernet transceiver is required.

2) Using Modem

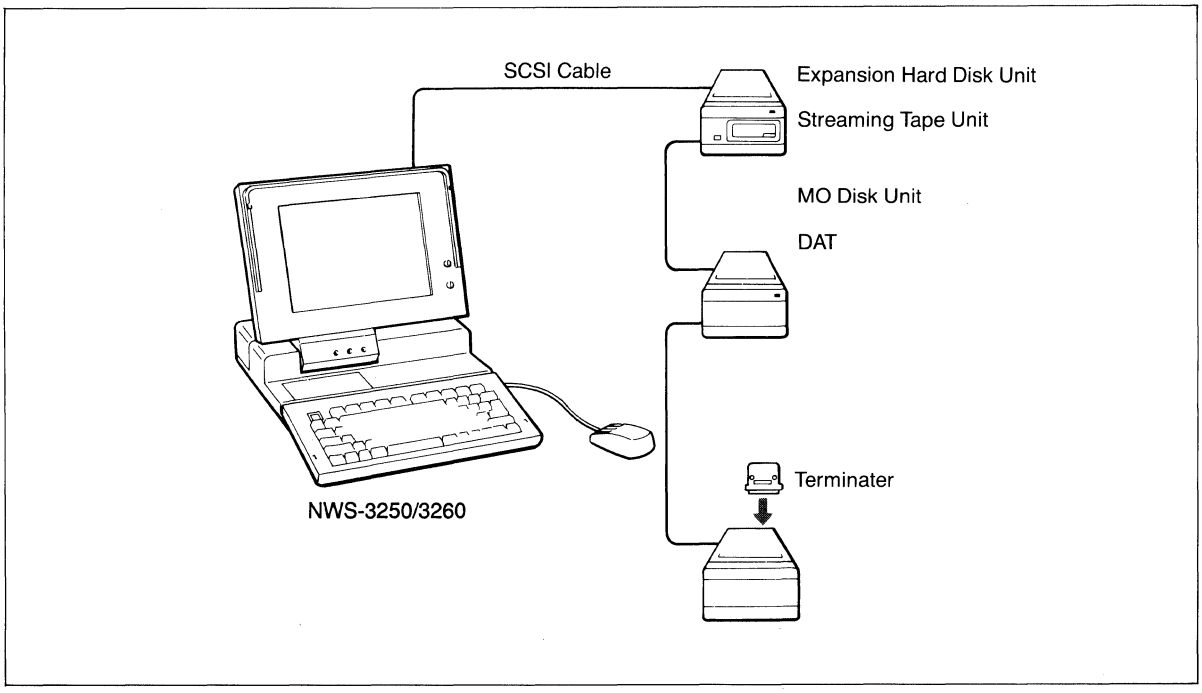
Using an optional modem board (NWB-238*), communication with a telephone circuit can be realized.



*NWB-238 is designed based on the Japanese telecommunication standard and can be used only in Japan.

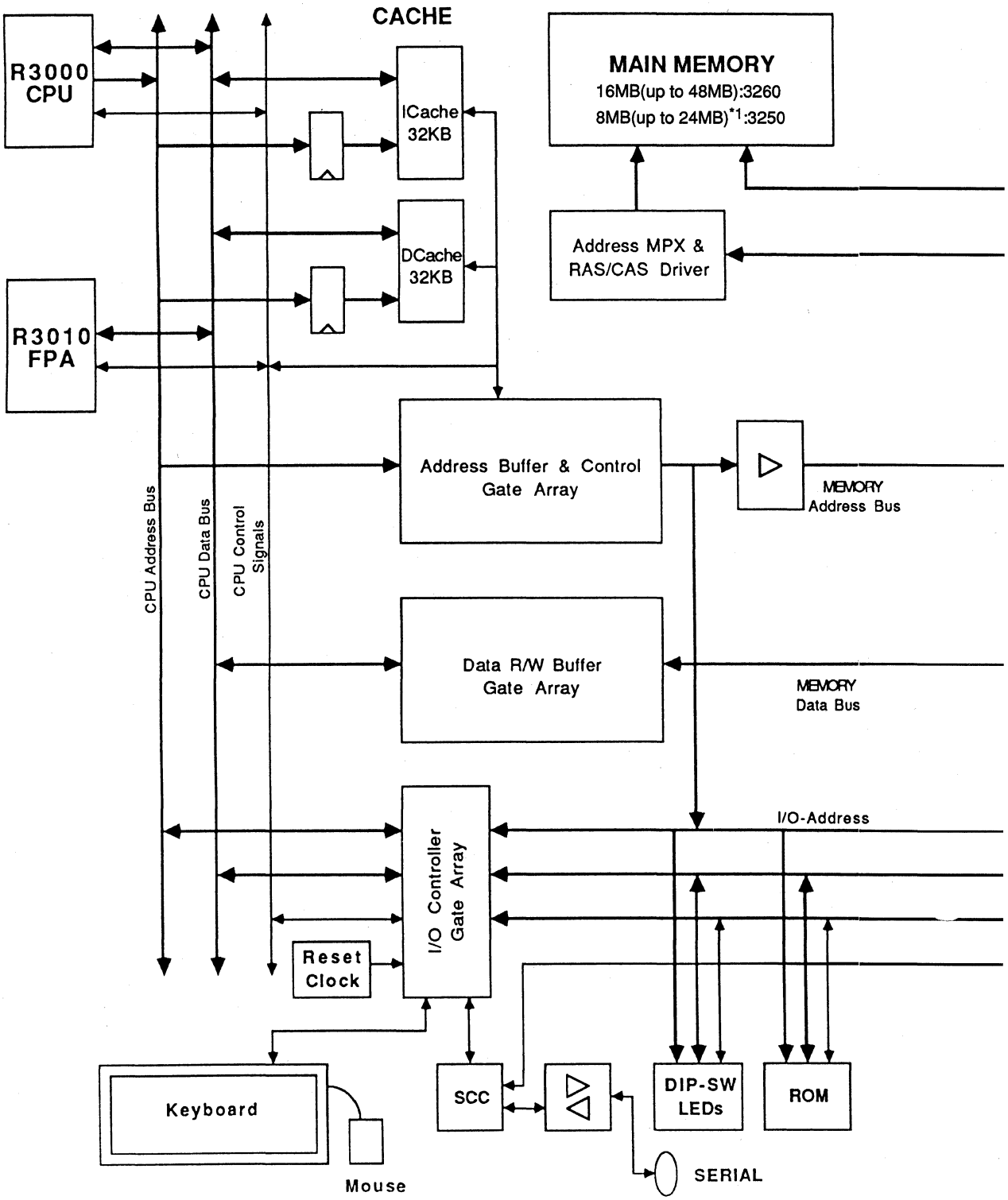
3) Connection to Expansion Hard Disk Unit

In addition to a built-in Hard Disk Unit, up to 6 units of External Storage Units such as Hard Disk Unit, MO Disk Drive Unit, DAT Data Storage Unit, or up to 4 units of Streaming Tape Unit can be connected.

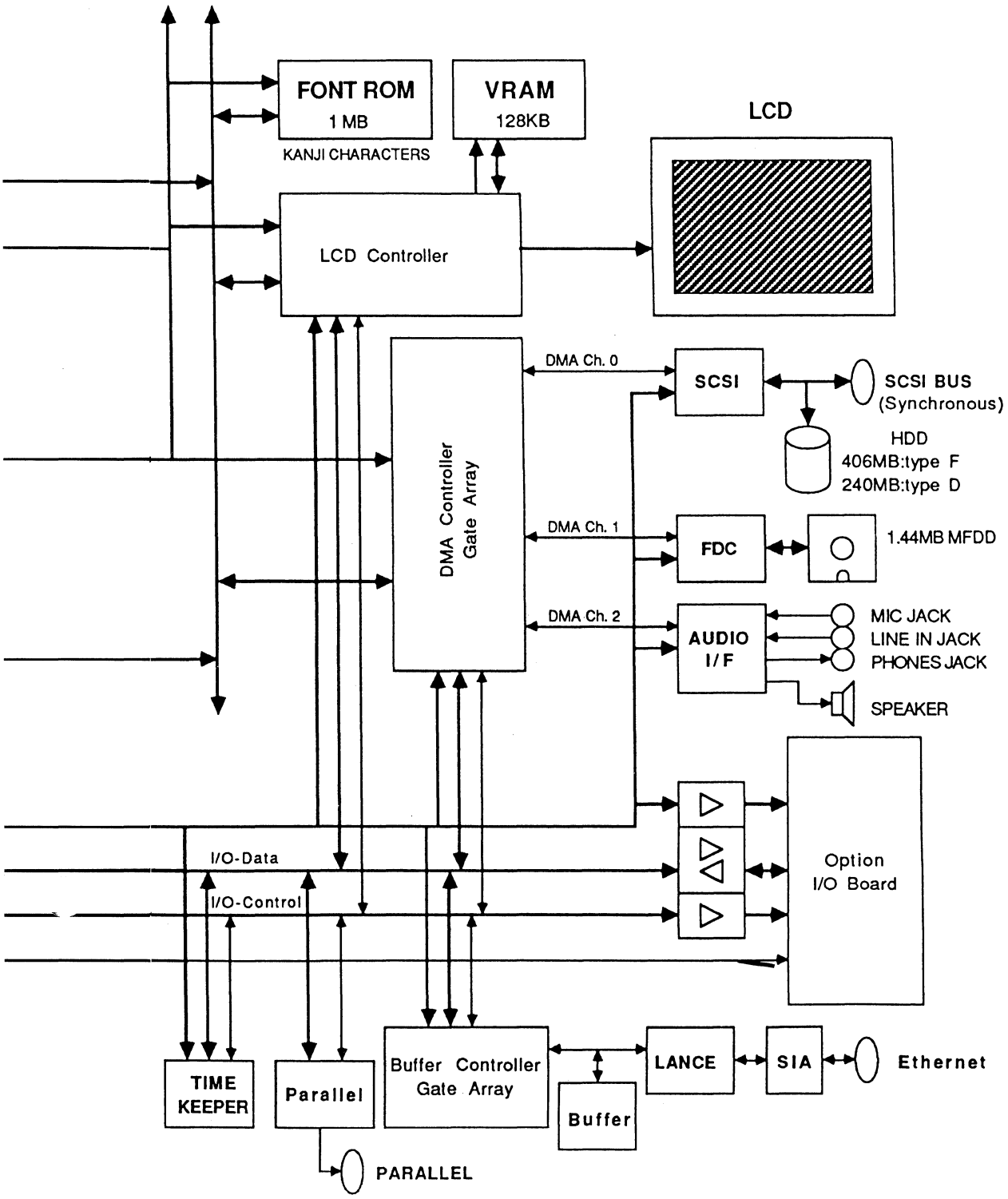


*Connection between the NWS-1250 and the first storage device must be done via the PCZ-310T SCSI cable.

4. Block Diagram

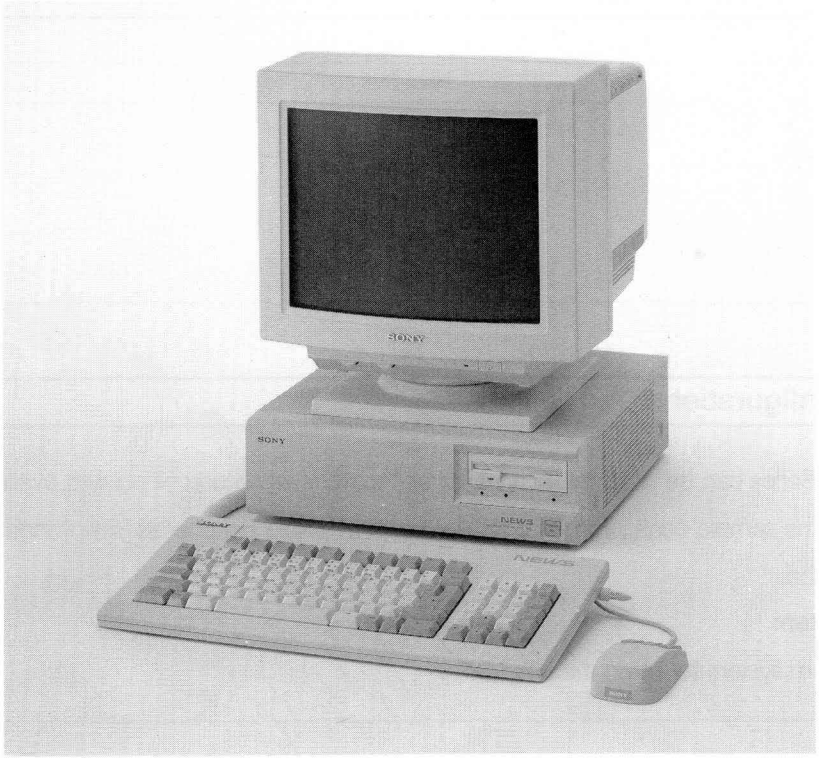


*1: Main memory of NWS-3250 can be expanded up to 36MB if you replace the initial 4MB memory modules with 16MB ones.


FONT ROM
1 MB
KANJI CHARACTERS
VRAM
128KB
LCD
LCD Controller
DMA Controller
Gate Array
DMA Ch. 0
SCSI
SCSI BUS
(Synchronous)
HDD
406MB:type F
240MB:type D
DMA Ch. 1
FDC
1.44MB MFDD
DMA Ch. 2
AUDIO
I/F
MIC JACK
LINE IN JACK
PHONES JACK
SPEAKER
Option
I/O Board
I/O-Data
I/O-Control
TIME
KEEPER
Parallel
PARALLEL
Buffer Controller
Gate Array
Buffer
LANCE
SIA
Ethernet

1.5.12 NEWS 3400 Series

NWS-3410
NWS-3410 (Type A)
NWS-3410 (Type D)
NWS-3410 (Type E)
NWS-3460



NWS-3460

Based on a powerful RISC (Reduced Instruction Set Computer) architecture CPU, the 3400 Series workstations deliver 17 MIPS of CPU processing power and 2.3 MFLOPS double precision floating-point arithmetic computations.

1. The NWS-3400 Series has these standard features:

- 20 MHz R3000 CPU.
- 20 MHz R3010 floating-point accelerator.
- 17 MIPS system performance.
- 2.3 MFLOPS double precision floating-point arithmetic computations.
- 8 MB of main memory, expandable to 16 MB in 4 MB steps.
- 1.44MB (formatted) 3.5 inch floppy disk drive.
- Built-in Hard Disk Drive:
  - 240MB (formatted) for NWS-3410 (Type D).
  - 415MB (formatted) for NWS-3460, and NWS-3410 (Type E).
- Built-in Ethernet Controller.
- Built-in two-channel RS-232C serial port.
- Built-in Parallel port for printer connection.
- Built-in Keyboard/mouse interface.
- Built-in SCSI bus for external storage devices.

(continued...)

- Built-in Audio Interface (equivalent to NWA-033) with separate MIC/Speaker.
- One expansion slot.

2. Comparison of NWS-3410, NWS-3410A, NWS-3410D and NWS-3460

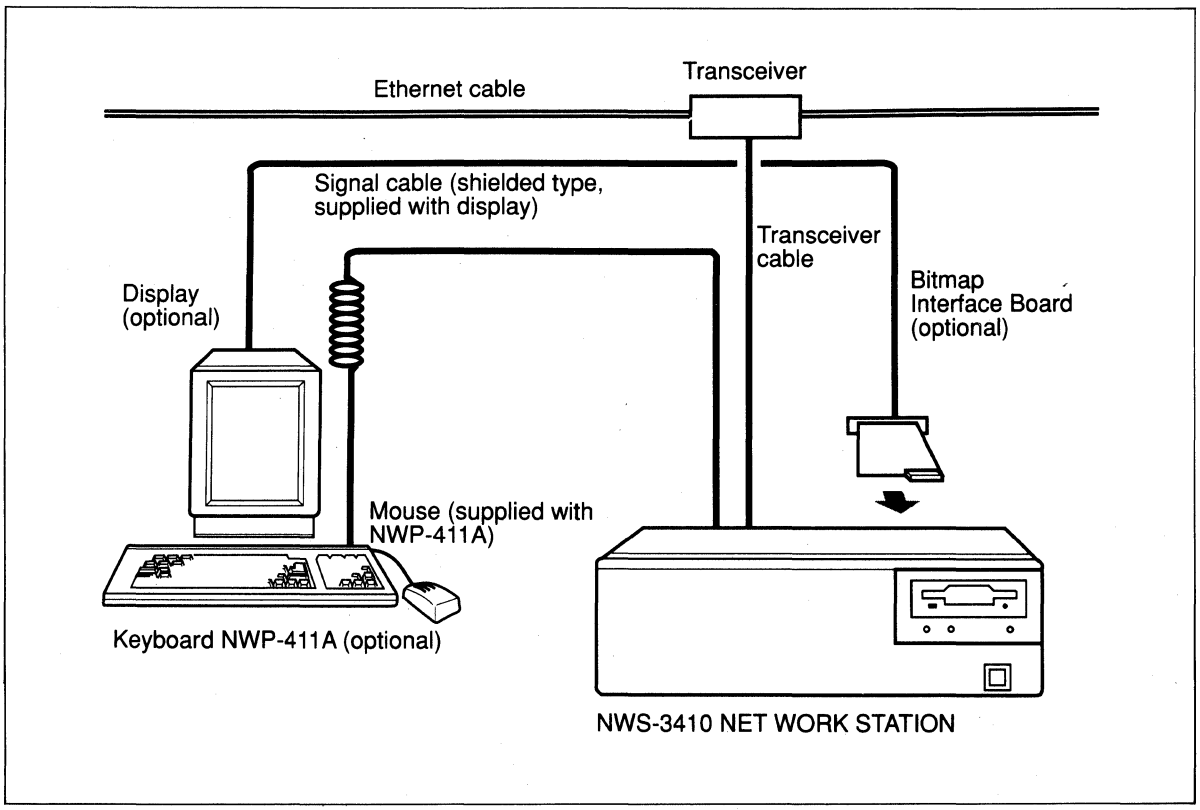
MODEL	Hard Disk (formatted)
NWS-3410	Diskless
NWS-3410 (Type A)	Diskless
NWS-3410 (Type D)	240 MB
NWS-3410 (Type E)	415 MB
NWS-3460	415 MB

3. Sample Configurations

The NEWS 3400 Series can be used for a variety of applications when combined with available peripherals. Followings are some sample configurations combined with available peripherals. Followings are examples of system configuration:

1) Standard System

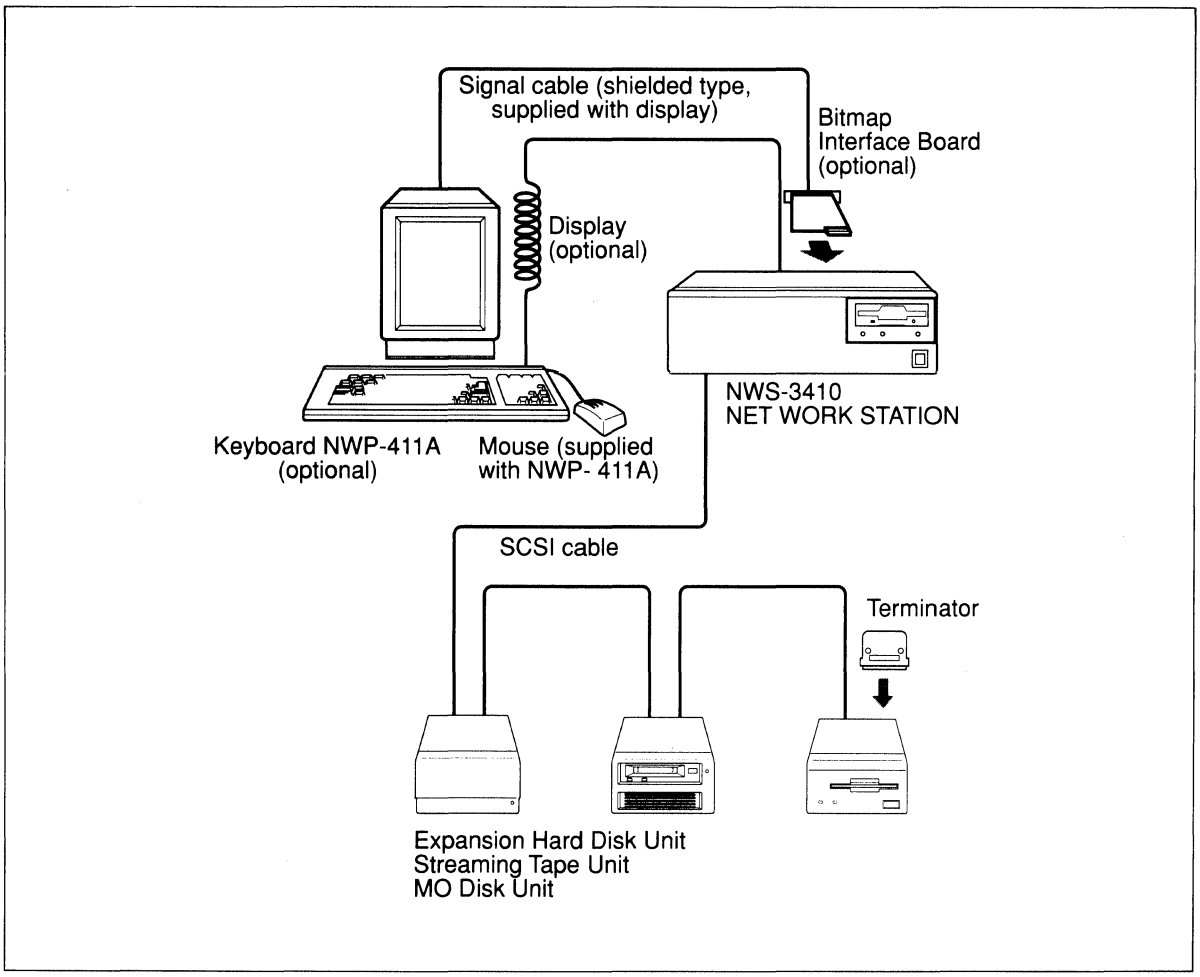
This is the minimum system for using the NWS-3410.

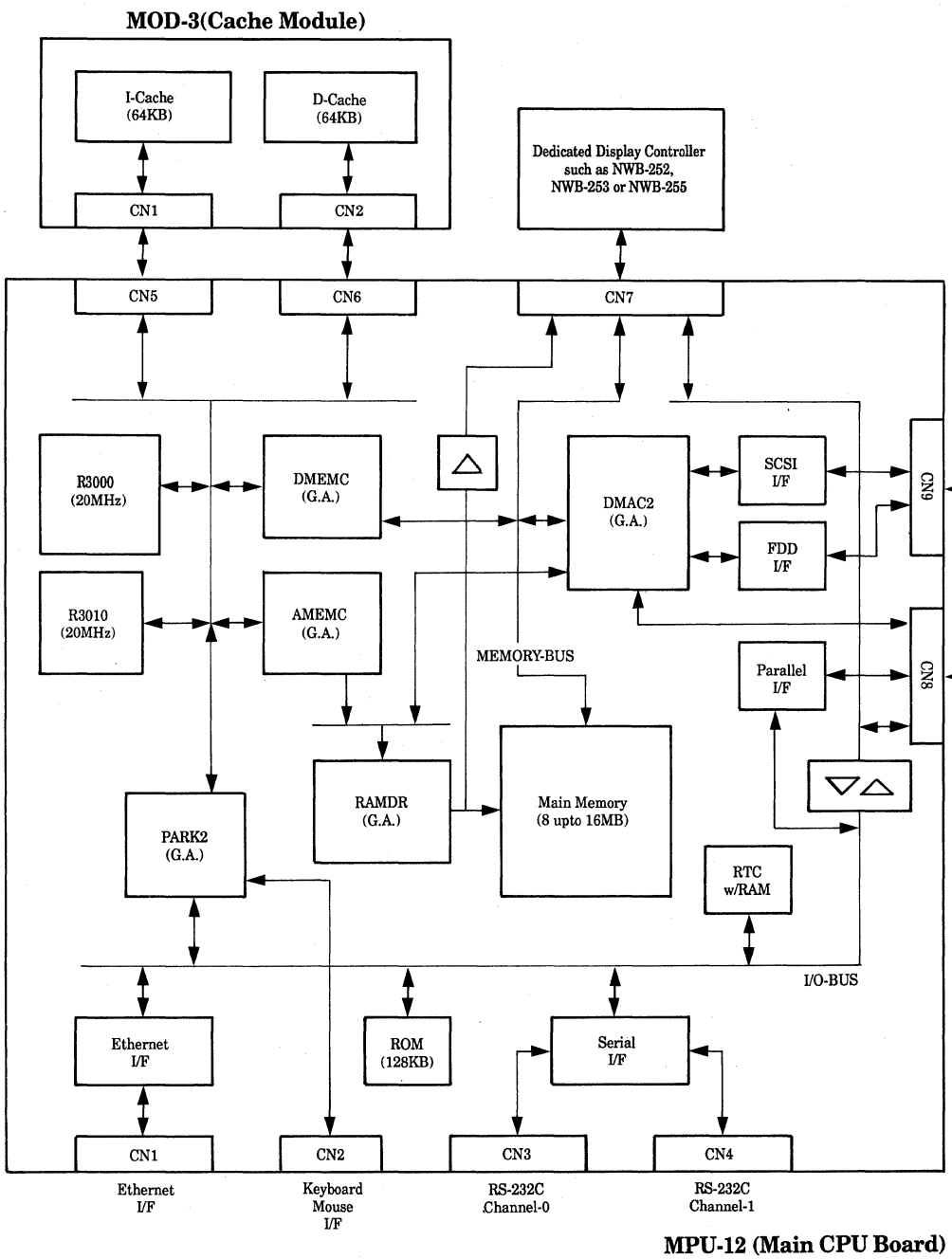


When using the workstation as a stand-alone system, no Ethernet transceiver is required.

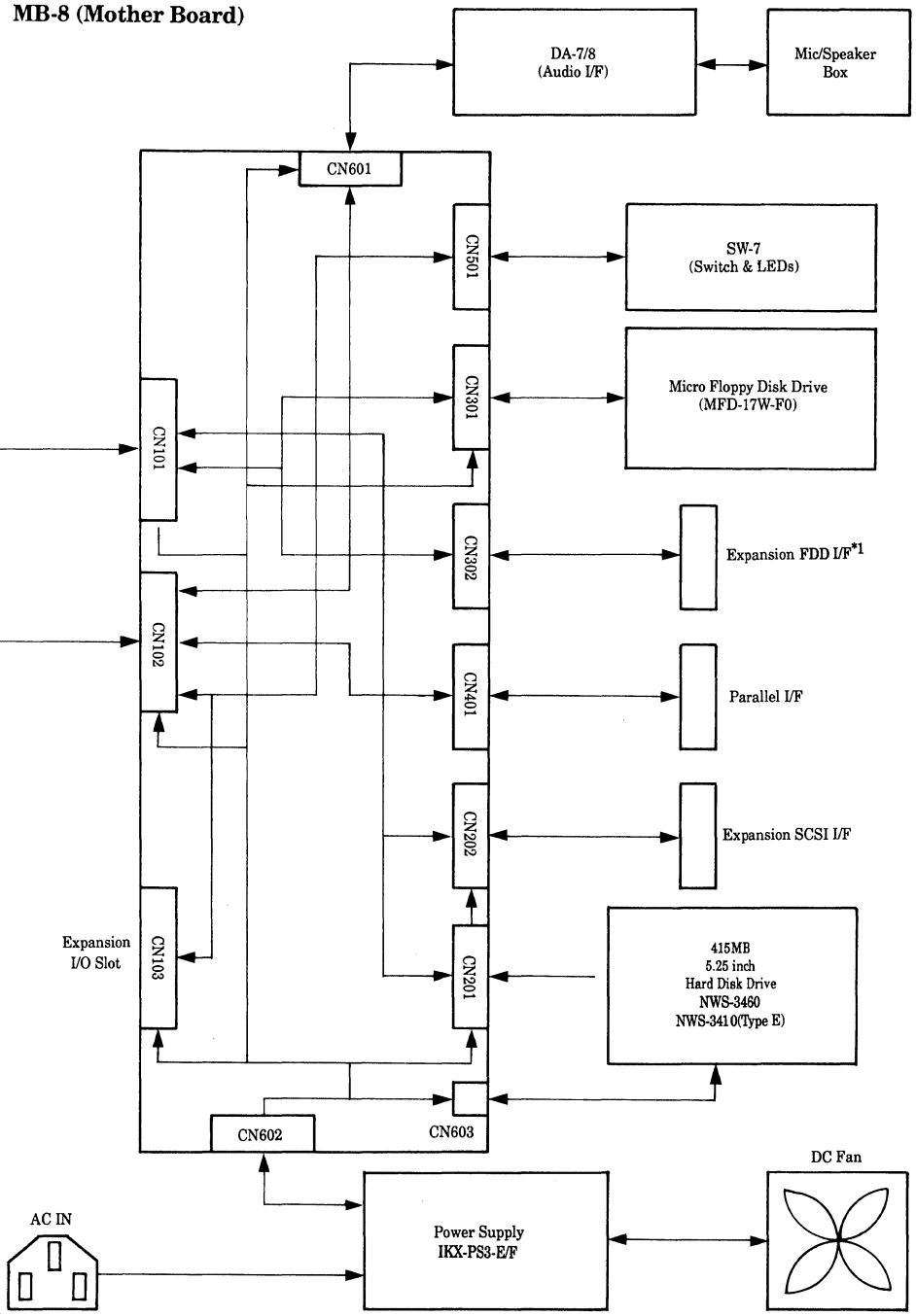
2) Expanded System with Peripheral Storage Units

Up to 6 units of External Storage Units such as Hard Disk Unit, MO Disk Drive Unit, DAT Data Storage Unit, or up to 4 units of Streaming Tape Unit can be connected.




MOD-3(Cache Module)
I-Cache (64KB)
D-Cache (64KB)
CN1
CN2
Dedicated Display Controller such as NWB-252, NWB-253 or NWB-255
CN5
CN6
CN7
R3000 (20MHz)
DMEMC (G.A.)
DMAC2 (G.A.)
SCSI I/F
FDD I/F
CN9
R3010 (20MHz)
AMEMC (G.A.)
MEMORY-BUS
Parallel I/F
CN8
RAMDR (G.A.)
Main Memory (8 upto 16MB)
PARK2 (G.A.)
RTC w/RAM
I/O-BUS
Ethernet I/F
ROM (128KB)
Serial I/F
CN1
CN2
CN3
CN4
Ethernet I/F
Keyboard Mouse I/F
RS-232C Channel-0
RS-232C Channel-1
MPU-12 (Main CPU Board)

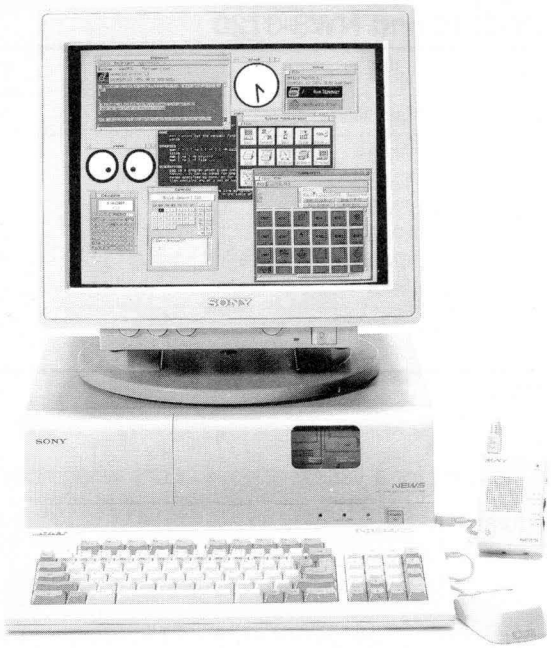
MB-8 (Mother Board)



*1: Expansion FDD I/F is equipped with J model only.

1.5.13 NEWS 3700 Series

NWS-3710 (Type A)
NWS-3710 (Type D)
NWS-3710 (Type F)
NWS-3720 (Type A)
NWS-3720 (Type G)
NWS-3720 (Type I)



NWS-3710

Based on a powerful RISC (Reduced Instruction Set Computer) architecture CPU, the NWS-3700 Series workstations deliver 17 MIPS of CPU processing power and 2.3 MFLOPS double precision floating point arithmetic computations.

1. The NWS-3700 Series has these standard features:

- 20MHz R3000 CPU.
- 20MHz R3010 floating-point accelerator.
- 17MIPS system performance.
- 2.3MFLOPS double precision floating-point arithmetic computations.
- 8MB of main memory, expandable to 32MB. (NWS-3710)
- 16MB of main memory, expandable to 128MB. (NWS-3720)
- 1.44MB (formatted) 3.5 inch floppy disk drive.
- Built-in Hard Disk Drive:
  - 286MB (formatted) for NWS-3710 (Type D)
  - 640MB (formatted) for NWS-3710 (Type F), and NWS-3720 (Type G)
  - 1.25GB (formatted) for NWS-3720 (Type I)
- Built-in Ethernet Controller.
- Built-in two-channel RS-232C Serial Port.
- Built-in Parallel port for printer connection.

(continued...)

- Built-in Keyboard/mouse interface.
- Built-in SCSI bus for external storage devices.
- Built-in Audio Interface (equivalent to NWA-033) with separate MIC/Speaker.
- Three expansion Slots.

2. Comparison of NWS-3710 and NWS-3720

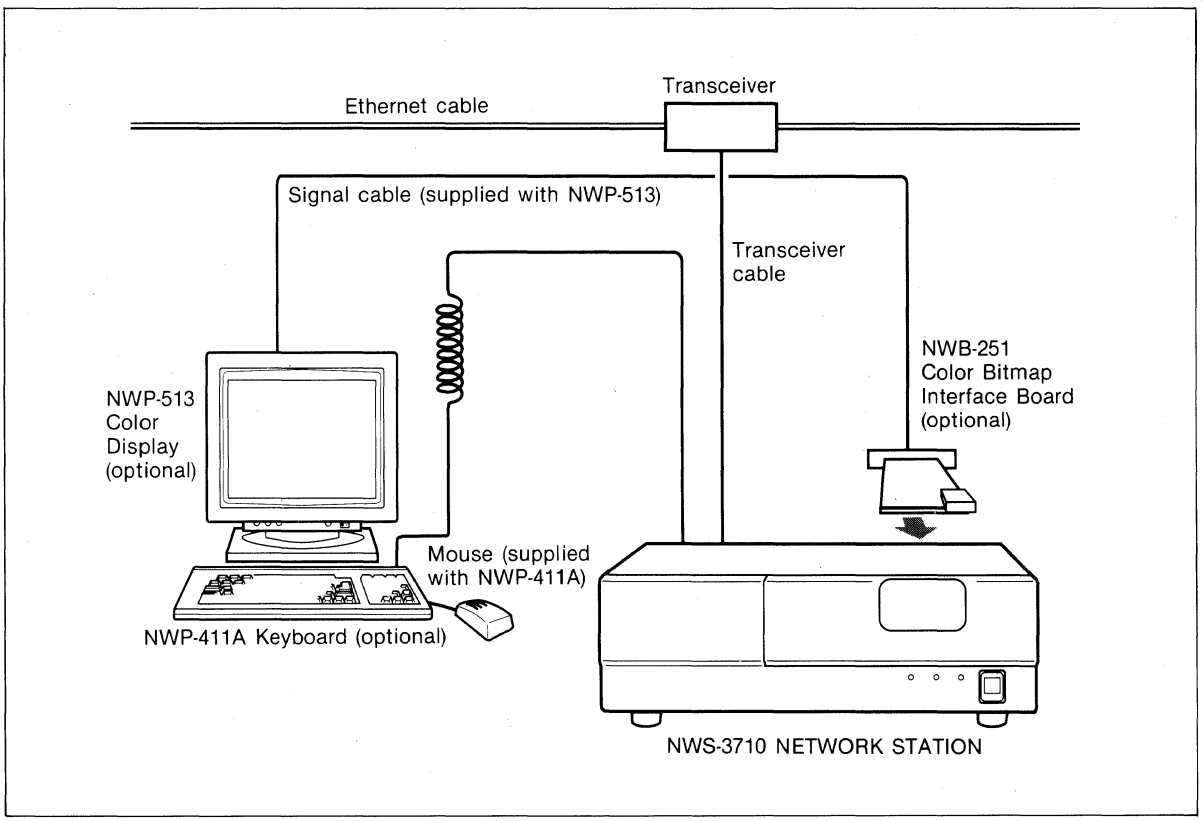
MODEL	Main Memory	Hard Disk (formatted)
NWS-3710 (Type A)	8MB	Diskless
NWS-3710 (Type D)	8MB	286MB
NWS-3710 (Type F)	8MB	640MB
NWS-3720 (Type A)	16MB	Diskless
NWS-3720 (Type G)	16MB	640MB
NWS-3720 (Type I)	16MB	1.25GB

3. Sample Configurations

The NEWS 3700 Series can be used for a variety of applications when combined with available peripherals.

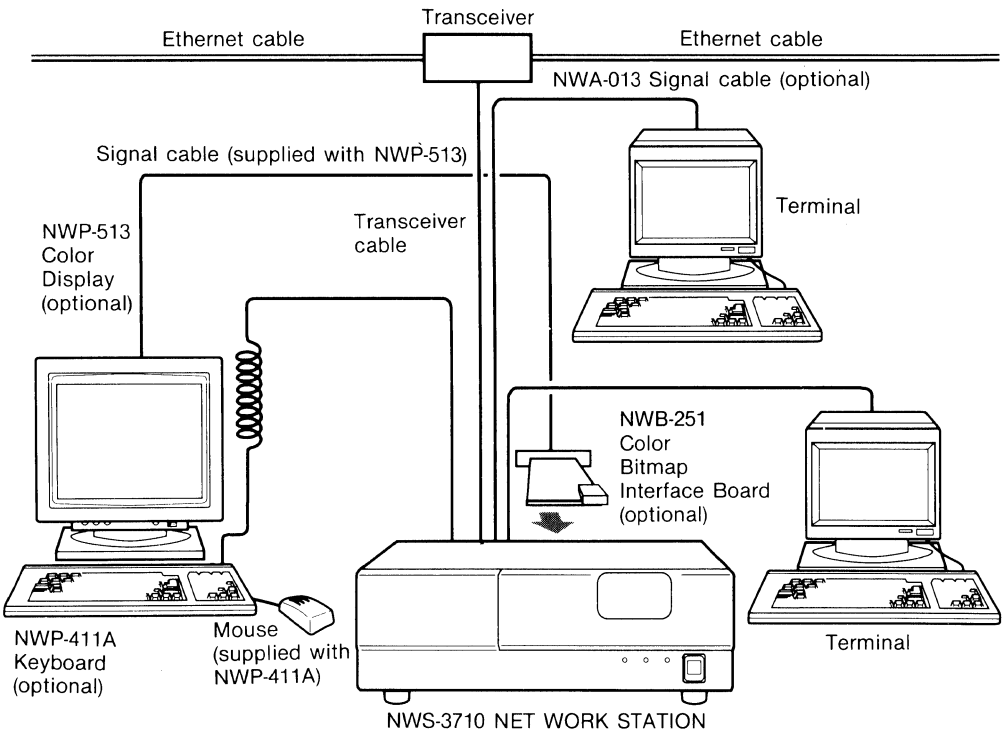
Followings are sample configurations:

1) Color Display System

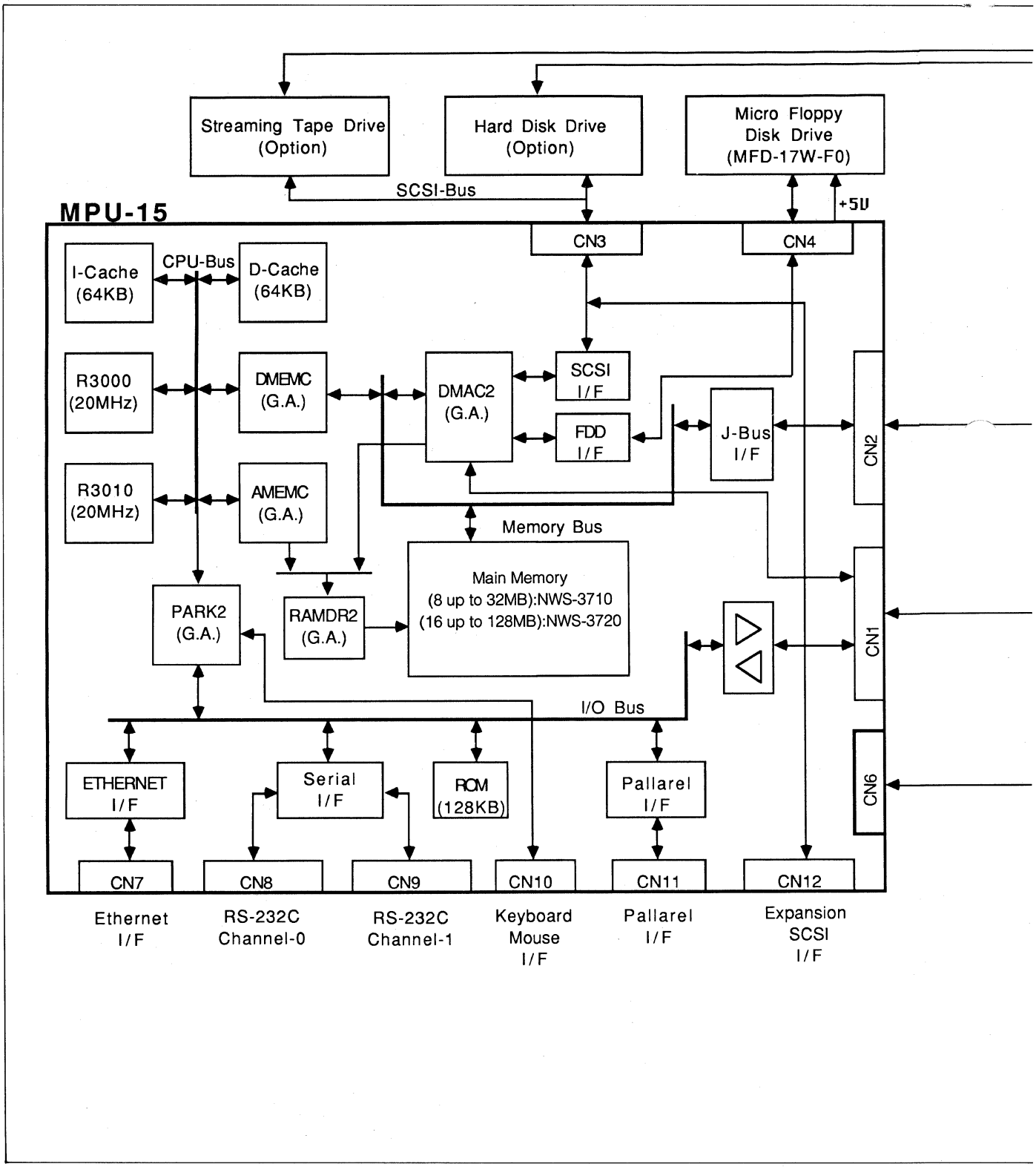


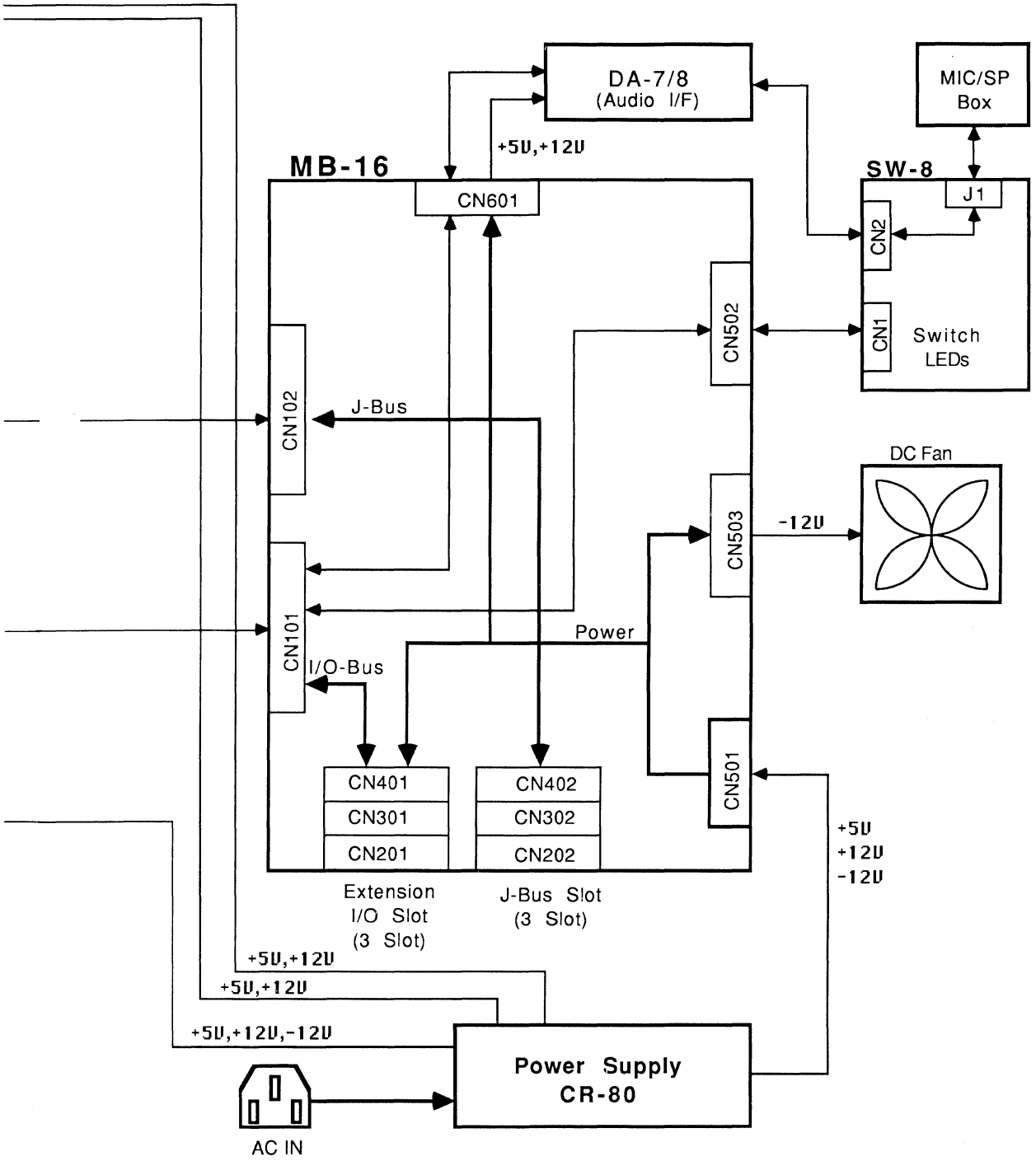
When using the workstation as standalone system, no Ethernet transceiver is required.

2) Multiple User System with Monitor and Two Terminals



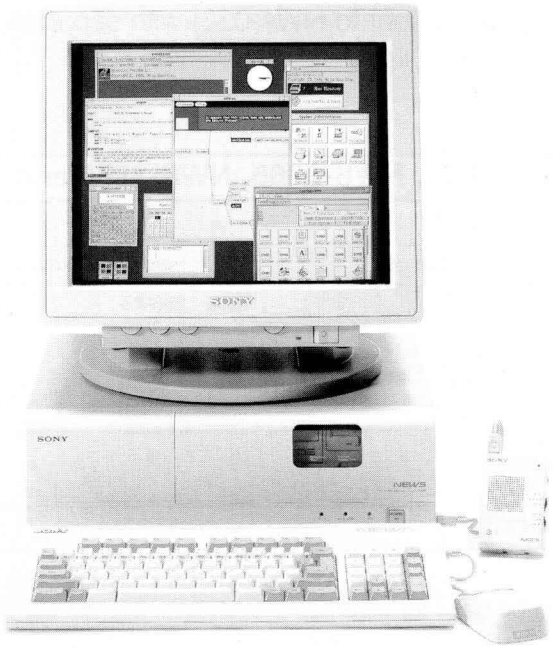
4. Block Diagram




DA-7/8
(Audio I/F)
MIC/SP
Box
+5V,+12V
MB-16
SW-8
CN601
J1
CN2
CN502
CN1
Switch
LEDs
CN102
J-Bus
DC Fan
CN503
-12V
CN101
Power
I/O-Bus
CN501
CN401
CN301
CN201
CN402
CN302
CN202
+5V
+12V
-12V
Extension
I/O Slot
(3 Slot)
J-Bus Slot
(3 Slot)
+5V,+12V
+5V,+12V
+5V,+12V,-12V
Power Supply
CR-80
AC IN

1.5.14 NEWS 3800 Series

NWS-3840
NWS-3860
NWS-3865 (Type G)
NWS-3865 (Type E)
NWS-3870



NWS-3860

Based on a powerful RISC (Reduced Instruction Set Computer) architecture, the NWS-3800 Series workstations deliver 20 MIPS of CPU processing power and 3.4 MFLOPS double precision floating-point arithmetic computations.

1. The NWS-3800 Series has these standard features:

- 20MHz R3000 CPU for NWS-3860/3840 and 25MHz R3000 CPU for NWS-3870/3865.
- 20MHz R3010 floating-point accelerator for NWS-3860/3840, and 25MHz R3010 floating point accelerator for NWS-3870/3865.
- 20MIPS system performance (NWS-3860/3840) and 25MIPS system performance for NWS-3870/3865.
- 3.4MFLOPS double precision floating-point arithmetic computations for NWS-3860/3840.
- 4.3MFLOPS double precision floating-point arithmetic computations for NWS-3870/3865.
- 16MB Main Memory, expandable to 80MB for NWS-3865/3860/3840 and 64MB Main memory expandable to 128MB for NWS-3870.
- 1.44MB (formatted) 3.5inch floppy disk drive.
- Built-in Hard Disk Drive:

  286MB (formatted) for NWS-3840

  640MB (formatted) for NWS-3865 (Type E), NWS-3860.

  1.25GB (formatted) for NWS-3870, NWS-3865 (Type G).

(continued...)

- Built-in Ethernet Controller.
- Built-in two-channel RS-232C serial port.
- Built-in Parallel port for printer connection.
- Built-in Keyboard/mouse interface.
- Built-in SCSI bus (×2) for external storage devices.
- Built-in Audio Interface (equivalent to NWA-033) with separate MIC/Speaker.
- Three expansion slots.

2. Comparison of NWS-3870, NWS-3865, NWS-3860 and NWS-3840

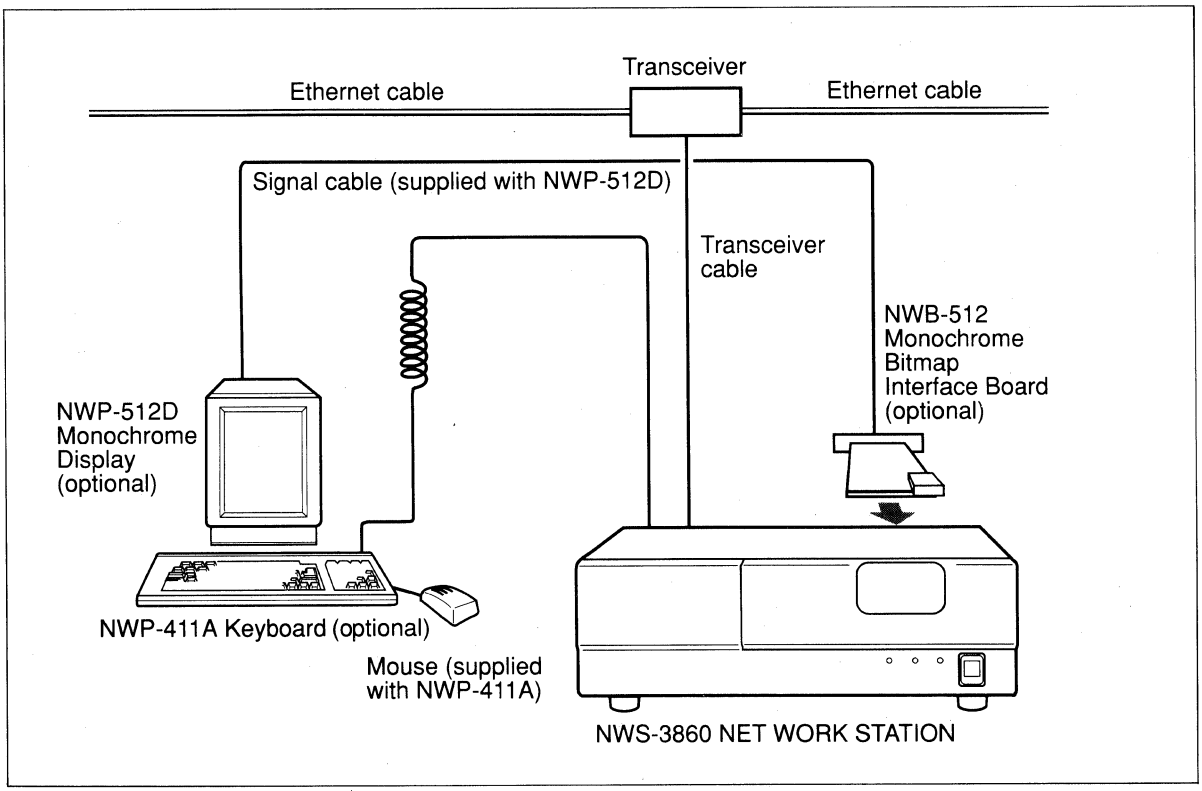
MODEL	Main Memory	Hard Disk (formatted)	Streamer
NWS-3840	16MB	286MB	—
NWS-3860	16MB	640MB	150/125MB
NWS-3865 (Type E)	16MB	640MB	150/125MB
NWS-3865 (Type G)	16MB	1.25GB	150/125MB
NWS-3870	64MB	1.25GB	150/125MB

3. Sample Configurations

The NEWS 3800 Series can be used for a variety of applications when combined with availabel peripherals.

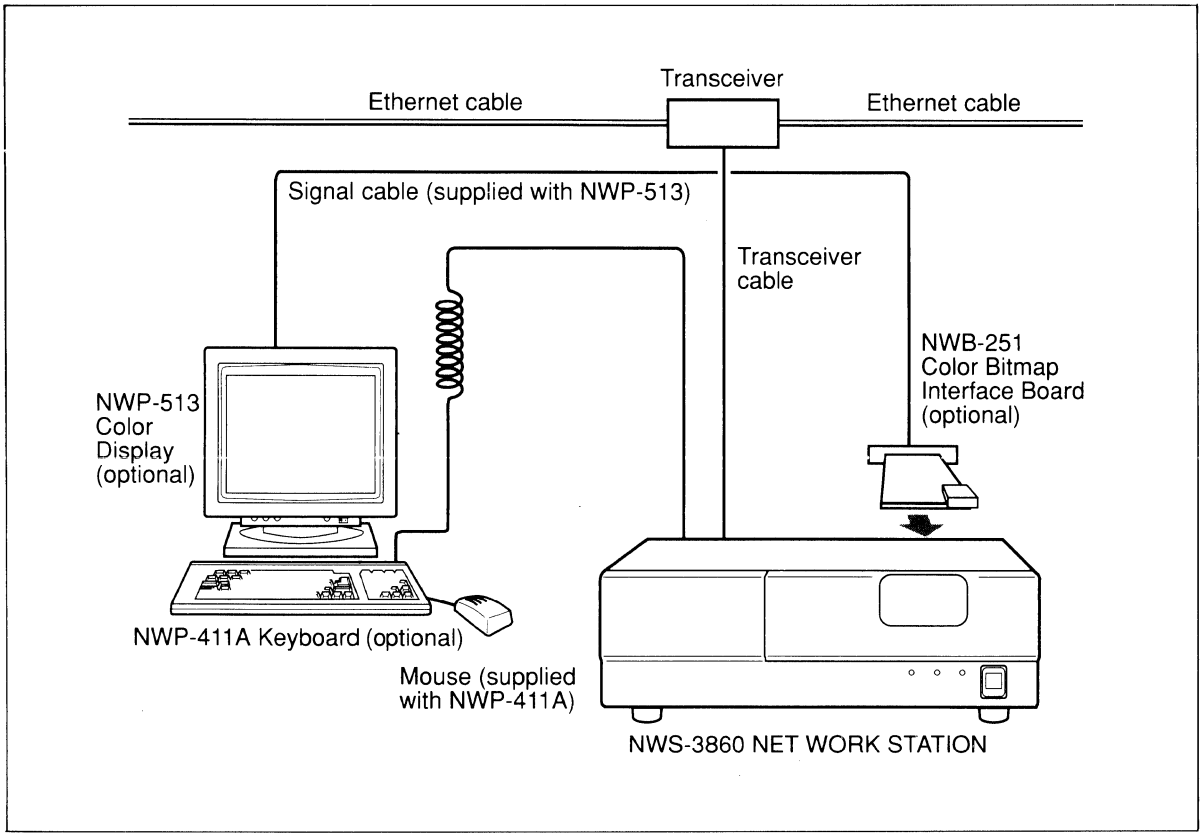
Followings are some sample configurations:

1) Monochrome Display System



When using the workstation as a standalone system, no Ethernet transceiver is required.

2) Color Display System



4. Block Diagram

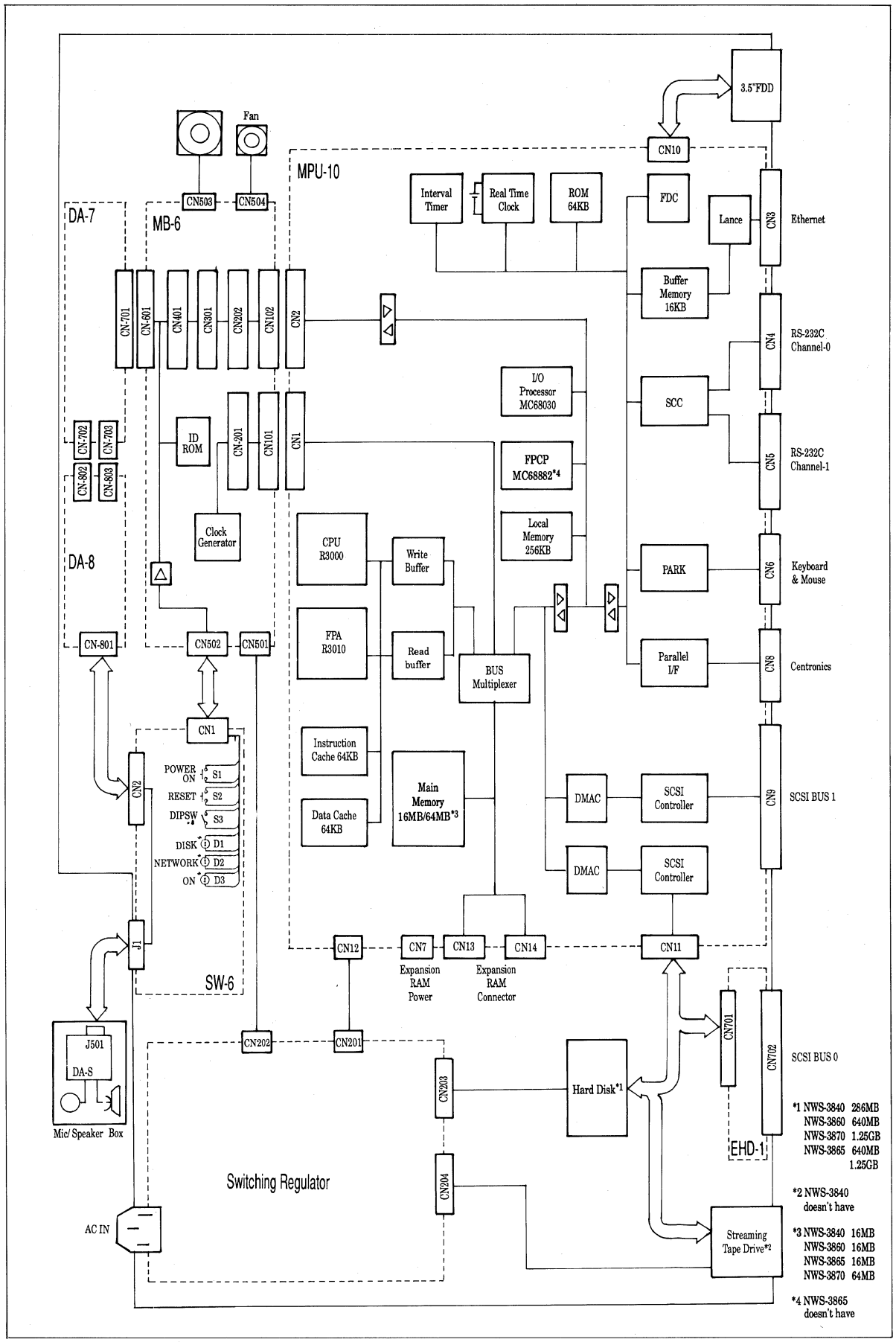


Table 1.5-1 (1)

NEWS System Performance Comparisons

MPU Board	MPU-4	MPU-6		MPU-2			MPU-3		Modified MPU-3		MPU-7			MPU-8
	700 Series			800 Series					900 Series		1500 Series			1600 Series
	NWS-711 (UC, J)	**NWS-712** (EK)	**NWS-721** (UC, EK, J)	**NWS-811** (J)	**NWS-891** (J)	**NWS-821** (J)	**NWS-831** (J)	**NWS-841** (J, UC)	**NWS-911** (J)	**NWS-921** (J)	**PWS-1520** (J)	**PWS-1550** (J)	**PWS-1560** (J)	**PWS-1630** (J)
CPU	MC68020 (16.67MHz)	MC68020 (20MHz)		MC68020 (16.67MHz)					MC68020 (16.67MHz)		MC68030 (25MHz)			MC68030 (25MHz)
I/O Processor	—	—		MC68020 (16.67MHz)					MC68020 (16.67MHz)		—			—
Floating-Point Coprocessor	MC68881 (16.67MHz)	MC68881 (20MHz)		MC68881 (16.67MHz)					MC68882 (20MHz)		MC68881 (25MHz)			MC68882 (25MHz)
MIPS Value	2.3	2.8		2.3			2.4		2.4		3.9			4.3
Main Memory	4MB	4MB (expandable to 8MB)		4MB			8MB (expandable to 16MB)		8MB (expandable to 16MB)		4MB (expandable to 16MB)			8MB (expandable to 32MB)
Cache Memory	—			—			8KB		8KB		—			16KB
Streamer	—			—					125MB		—			—
3.5″ FDD (formatted)	—			1.44MB					1.44MB		1.44MB			1.44MB
Hard Disk (formatted)	—			—	86MB	156MB		286MB	286MB × 2	286MB × 4	40MB	91MB		170MB
Misc.	—			—	540MB (CD-ROM)	—			—		—			—
Standard Interfaces	Ethernet	Ethernet	Ethernet	Ethernet, SCSI, RS232C (× 2), Centronics parallel					Ethernet, SCSI, RS232C (× 2), Centronics parallel, VME (× 4)		Ethernet, SCSI, RS232C (× 2), Centronics parallel, Expansion FDD*1			Ethernet, SCSI, RS232C(×) Contronics parallel, Expansion FDD*1
Expansion Slots	—			2					4		1			3
Dimensions (mm) (W × D × H) (inch)	326 × 412 × 380 ($12^{7}/_{8} \times 16^{1}/_{4} \times 15$)	430 × 370 × 140 ($5^{1}/_{2} \times 13^{1}/_{8} \times 9^{7}/_{8}$)		430 × 370 × 140 ($17 \times 14^{5}/_{8} \times 5^{5}/_{8}$)					300 × 650 × 600 ($11^{7}/_{8} \times 25^{5}/_{8} \times 23^{5}/_{8}$)		355 × 341 × 110 ($14 \times 13^{2}/_{5} \times 4^{3}/_{8}$)			430 × 377 × 145 ($17 \times 14^{7}/_{8} \times 5^{3}/_{4}$)
Weight	Approx. 19kg (41 lb 15 oz)	Approx. 5kg (12 lb 16 oz)		Approx. 17kg (37 lb 8 oz)					Approx. 46kg (101 lb 9 oz)	Approx. 53kg (117 lb)	Approx. 10kg (22 lb 1 oz)			
Remarks	Supplied with B/W display (816 × 1,024 dots), keyboard and mouse	Supplied with keyboard and mouse		—					—		Supplied with B/W Display Controller		Supplied with Color Display Controller	—
		B/W bitmap display	Color bitmap display											

Notes: 1) Grasping the difference of each MPU board enables the understanding of the relation between the expansion RAM board and main unit; and MIPS value and main unit (refer to the Table 1.9-1 NEWS Products-Interrelationship Table-① ②).

2) NEWS-OS Release 4.0: UNIX 4.2 BSD/4.3 BSD + NFS 4.0 + X Window System Version 11 Release 4, some System V functions, OSF/Motif Release 1.1, NEWS Desk.

- Languages CISC series: C, Fortran 77, Franz Lisp, Pascall. Smalltalk-80 is optionally available.
  RISC series: C, Fortran and Pascal are optionally available.
- Graphics: CGI
- Communication: TCP/IP + XNS

*1 Expansion FDD is available for J version only.

Table 1.5-1 (2)

NEWS System Performance Comparisons

MPU Board	MPU-7			MPU-7				MPU-8			MPU-5					MPU-13	
	1400 Series			1500 Series				1700 Series			1800 Series			1900 Series		1200 Series	
	NWS-1410 (J)	**NWS-1450** (J)	**NWS-1460** (J)	**NWS-1510** (EK)	**NWS-1520** (EK)	**NWS-1530** (EK)	**NWS-1580** (EK)	**NWS-1710** (UC)	**NWS-1720** (UC, EK, J)	**NWS-1750** (UC, EK, J)	**NWS-1830** (UC, EK, J)	**NWS-1850** (UC, EK, J)	**NWS-1860** (J)	**NWS-1930** (UC, EK)	**NWS-1960** (J)	**NWS-1230** (J)	**NWS-1250** (J, EK)
CPU	MC68030 (25MHz)			MC68030 (25MHz)				MC68030 (25MHz)			MC68030 (25MHz)			MC68030 (25MHz)		MC68030 (25MHz)	
I/O Processor	—			—				—			MC68030 (25MHz)			MC68030 (25MHz)		—	
Floating-Point Co-processor	MC68882 (25MHz)			MC68882 (25MHz)				MC68882 (25MHz)			MC68882 (25MHz)			MC68882 (25MHz)		MC68882 (25MHz)	
MIPS Value	3.9			3.9				4.3			5.3			5.3		3.9	
Main Memory	8MB (expandable to 16MB)			4MB (expandable to 16MB)				4MB (expandable to 32MB)		4MB (UC) or 8MB (EK, J) (expandable to 16MB)	16MB (expandable to 32MB)			16MB (expandable to 32MB)		4MB (expandable to 12MB)	8MB (expandable to 12MB)
Cache Memory	—			—				16KB			64KB			64KB		—	
Streamer	—			—				—		125MB	—	125MB	150MB	125MB		—	
3.5″ FDD (formatted)	1.44MB			1.44MB				1.44MB			1.44MB			1.44MB		1.44MB	
Hard Disk (formatted)	240MB			40MB	—	40MB	170MB	—	156MB	286MB	156MB	286MB	640MB	286MB × 1 (UC) (expandable to × 4) 286MB × 2 (EK)	286MB × 3	200MB	240MB
Misc.	—			—				—			—			—	594MB (MO Disk Drive)	—	
Standard Interfaces	Ethernet, SCSI, RS232C (× 2), Centronics parallel, Expansion FDD*1			Ethernet, SCSI, RS232C (× 2), Centronics parallel				Ethernet, SCSI, RS232C (× 2), Centronics parallel	Ethernet, SCSI, RS232C (× 2), Centronics parallel, Expansion FDD*1		Ethernet, SCSI, RS232C (× 2), Centronics parallel			Ethernet, SCSI, RS232C (× 2), Centronics parallel VME (× 5)	Ethernet, SISI, RS232C (× 2), Centronics parallel VME (× 4)	Ethernet, SCSI (half pitch), RS232C, Centronics parallel, Audio Interface, Mouse	
Expansion Slots	1			1				3			3			3	4	1	
Dimensions (mm) (W × D × H) (inch)	355 × 341 × 100 ($14 \times 13^{2}/_{5} \times 4$)			355 × 341 × 100 ($14 \times 13^{2}/_{5} \times 4$)				430 × 377 × 145 ($17 \times 14^{7}/_{8} \times 5^{3}/_{4}$)			430 × 377 × 145 ($17 \times 14^{7}/_{8} \times 5^{4}/_{4}$)			300 × 770 × 600 ($11^{7}/_{8} \times 30^{3}/_{8} \times 25^{5}/_{8}$)		348 × 415 × 96 ($13^{3}/_{4} \times 16^{3}/_{8} \times 3^{7}/_{8}$) (projections are not included)	
Weight	Approx. 10kg (22 lb 1 oz)			Approx. 10kg (22 lb 1 oz)				Approx. 11.2kg (24 lb 11 oz)	Approx. 15.2kg (33 lb 8 oz)		Approx. 15.2kg (33 lb 8 oz)			47kg (103lb 12 oz) for UC model 50kg (110 lb 4 oz) for EK model	Approx. 52kg (114 lb 10 oz)	Approx. 8kg (17 lb 11 oz)	
Remarks	—	Supplied with B/W Display Controller	Supplied with Color Display Controller	—	Supplied with B/W Display Controller	Supplied with Color Display Controller		—			—			—		Display: Baklit STN Liquid Crystal 11 inch.	

Notes: 1) Grasping the difference of each MPU board enables the understanding of the relation between the expansion RAM board and main unit; and MIPS value and main unit (refer to the Table 1.9-1 NEWS Products-Interrelationship Table-① ②).

2) NEWS-OS Release 4.0: UNIX 4.2 BSD/4.3 BSD + NFS 4.0 + X Window System Version 11 Release 4, some System V functions, OSF/Motif Release 1.1, NEWS Desk.

- Languages CISC series: C, Fortran 77, Franz Lisp, Pascall. Smalltalk-80 is optionally available.
  RISC series: C, Fortran and Pascal are optionally available.
- Graphics: CGI
- Communication: TCP/IP + XNS

*1 Expansion FDD is available for J version only.

Table 1.5-1 (3)

NEWS System Performance Comparisons

MPU Board	MPU-16			MPU-12					MPU-15							MPU-10				
	3200 Series			3400 Series					3700 Series							3800 Series				
	NWS-3250 (Type D) (UC)	**NWS-3250** (Type F) (UC)	**NWS-3260** (J/EK)	**NWS-3410** (J)	**NWS-3410** (Type A) (EK)	**NWS-3410** (Type D) (EK)	**NWS-3410** (Type E) (EK)	**NWS-3460** (J)	**NWS-3710** (Type A) (UC)	**NWS-3710** (Type D) (UC)	**NWS-3710** (Type F) (UC)	**NWS-3720** (J)	**NWS-3720** (Type A) (EK)	**NWS-3720** (Type G) (EK)	**NWS-3720** (Type I) (EK)	**NWS-3840** (J)	**NWS-3860** (J/EK)	**NWS-3865** (Type G) (EK)	**NWS-3865** (Type E) (EK)	**NWS-3870** (J)
CPU	R3000 (20MHz)			R3000 (20MHz)					R3000 (20MHz)							R3000 (20MHz)		R3000 (25MHz)		
I/O Processor	—			—					—							MC68030 (20MHz)		MC68030 (25MHz)		
Floating-Point Co-processor (Accelerator)	R3010 (20MHz)			R3010 (20MHz)					R3010 (20MHz)							R3010 (20MHz)		R3010 (25MHz)		
MIPS Value	17			17					17							20		25		
Main Memory	8MB (expandable to 24MB)		16MB (expandable to 48MB)	8MB (expandable to 16MB)					8MB (expandable to 32MB)			16MB (expandable to 128MB)				16MB (expandable to 80MB)				64MB (expandable to 128MB)
Cache Memory	64KB (32KB each for data and instructions)			128KB (64KB each for data and instructions)					128KB (64KB each for data and instruction.)							128KB (64KB each for data and instruction.)				
Streamer	—			—					—			150MB/tape	—	150MB/tape		—	150MB/tape			
3.5″ FDD (formatted)	1.44MB			1.44MB					1.44MB							1.44MB				
Hard Disk (formatted)	240MB	406MB	406MB	—	—	240MB	415MB	415MB	—	286MB	640MB	640MB	—	640MB	1.25GB	286MB	640MB	1.25GB	640MB	1.25GB
Misc.	—			—					—							—				
Standard Interfaces	Ethernet, SCSI (half pitch), RS232C, Centronics parallel, Audio Interface, Mouse			Ethernet, SCSI, RS232C (× 2), Centronics parallel, Audio Interface, Expansion FDD*1, Keyboard/Mouse					Ethernet, SCSI, RS232C (× 2), Centronics parallel, Audio Interface, Expansion FDD*1, Keyboard/Mouse							Ethernet, SCSI (× 2), RS232C (× 2), Centronics parallel, Audio Interface, Keyboard/Mouse				
Expansion Slots	1			1					3							3				
Dimensions (mm) (W × D × H) (inch)	348 × 415 × 96 ($13^{3}/_{4} \times 16^{3}/_{8} \times 3^{7}/_{8}$) (projections are not included)			355 × 341 × 110 ($14 \times 13^{1}/_{2} \times 4^{3}/_{8}$)					430 × 377 × 145 ($17 \times 14^{7}/_{8} \times 5^{3}/_{4}$)							430 × 377 × 145 ($17 \times 14^{7}/_{8} \times 5^{3}/_{4}$)				
Weight	Approx. 8kg (17 lb 11 oz)			Approx. 7.5kg (16 lb 9 oz)		Approx. 8.5kg (18 lb 12 oz)	Approx. 9kg (19 lb 14 oz)		Approx. 11kg (24 lb 4 oz)	Approx. 15kg (33 lb 1 oz)		Approx. 16kg (35 lb 5 oz)	Approx. 11kg (24 lb 4 oz)	Approx. 16kg (35 lb 5 oz)		Approx. 16kg (35 lb 5 oz)				
Remarks	Display: Backlit STN Liquid Crystal 11 inch.																			

Notes: 1) Grasping the difference of each MPU board enables the understanding of the relation between the expansion RAM board and main unit; and MIPS value and main unit (refer to the Table 1.9-1 NEWS Products-Interrelationship Table-① ②).

2) NEWS-OS Release 4.0: UNIX 4.3 BSD + NFS 4.0 + X Window System Version 11 Release 4, some System V functions, OSF/Motif Release 1.1, NEWS Desk.

- Languages CISC series: C, Fortran 77, Franz Lisp, Pascall, Smalltalk-80 are optionally available.
  RISC series: C, Fortran and Pascal are optionally available.
- Graphics: CGI
- Communication: TCP/IP + XNS

*1 Expansion FDD I/F is available for J version only.

1.6 Peripherals

Here we discuss the various categories of peripherals for the NEWS series. Comments are also provided on points requiring caution regarding the relationship between the system unit and boards, and their uses.

1.6.1. Keyboards

NWP-410 thumb shift keyboard

NWP-411 keyboard

Both include a mouse.

The major specifications are given below:

1) Keyboard

	NWP-410 (Japanese only)	NWP-411
Number of keys	98 key + Power ON key	93 key
Dimensions (W × H × D, not including cord)	430 × 40 × 195 mm	430 × 30 × 185 mm
Weight	Approx. 1.7 kg	Approx. 1.5 kg
Tilt adjustment	5 or 10 degrees	
Interface	TTL level Serial Interface 9600 bps	

Note: NWP-410 can not be connected to the NWS-700/800/900 Series.

2) Mouse

Buttons 3

Dimensions 62 × 29 × 100 mm (W × H × D, not including cord)

Weight Approx. 200g

Resolution 8 count/mm (200 CPI)

Interface TTL level Serial Interface 1200 bps

1.6.2. Floor stand

NWP-412 allows NWS-800/1600/1700/1800/3700/3800 Series. All of the units to be used vertically.

Major specifications

Dimensions 240 × 70.8 × 353 mm (W × H × D)

Weight 2 kg

1.6.3. VME box

Two types of VME box are available.

NWP-413 Accommodates up to five standard double-height VME boards*. However, one slot is taken up by the interface to the NEWS system unit.

NWP-414 Accommodates up to five double-height Eurocards*. However, one slot is taken up by the interface to the NEWS system unit.

Note that the permissible board size differs from the standard size. The NWP-414 should therefore be thought of as a VME box for use with the NWB-224/224P full color graphic interface board and NWB-226 VTR control interface board.

*See the VME bus section of Chap. 4.1 for details on card sizes.

Note: The NWB-234A VME interface board is required in order to use a VME box with a NEWS system unit.

Major specifications

	NWP-413	NWP-414
Dimensions (W × H × D) excluding protuberances and rubber feet.	430 × 130 × 370 mm	
Weight	Approx. 10 kg	
Permissible VME board type	Double height Eurocard (Standard size)	
Board size	233.35 × 160 × 1.6 mm	233.35 × 280 × 1.6 mm
Comment	Both VME boxes may be connected to NWS-800, 1700 and 1800 series system units. Requires NWB-234A to connect with NEWS workstation. The NWP-414 is designed for use with the NWB-224/224P and NWB-226.	

*See the Instruction Manuals which come with each product for details.

1.6.4. Displays

A variety of displays are available to meet different requirements. Note that the relationship between the video board and the display is a very important one. The following table summarizes major specifications and suitable display-board combinations.

Model Name		Resolution (dots)	Dimensions (mm) (W × H × D)	Weight (kg)	Interface Board	Suitable NEWS series
NWP-511F	14″ Kanji Terminal	—	326 × 339 × 351	9.1	*RS-232C port is used.	All except for the NWS-700 series. Comment: Operates in either ANSI or VT52 mode. ANSI mode: DEC VT282, 220, 100 and 80 capability. VT52 mode: Compatible with DEC VT52.
NWP-512D NWU-M19*3	15″ Monochrome Display	816 × 1,024	326 × 405 × 356	16	NWB-253	NWS-3400 series
					NWB-512	NWS-800, 900, 1700, 1800, 1900, 3800 series and NWS-1410, 1510, PWS-1630
					—	NWS-1520, PWS-1520/1550, NWS-1450 and NWS-712
					NWB-518	NWS-1410, 1510, PWS-1630, NWS-1700/1800/1900/3800/3700 series
NWP-514	19″ Grayscale Display	1,280 × 1,280	406 × 491 × 377	20	NWB-514	NWS-1700, 1800 and 1900 series NWS-1410, NWS-1510, PWS-1630, NWS-3400/3800/3700 series
					NWB-255	NWS-3400 series
NWP-515	14″ Color Display	1,024 × 768	348 × 355 × 411 (Tilt included)	13	—	NWS-1460, PWS-1560, and NWS-1530/1580
					NWB-252	NWS-3400 series
					NWB-254	NWS-1700/1800/1900/3400/3700/3800 series
NWP-513 NWU-C1601*3	17″ Color Display	1,280 × 1,024	406 × 406 × 450	29	NWB-225A	NWS-1410, 1510, PWS-1630, NWS-800/900/1700/1800/1900/3800 series
					NWB-225A (with NWB-280)	PWS-1630, NWS-800/900/1700/1800/1900/3800 series
					NWB-251	NWS-1410, 1510, PWS-1630, NWS-1700/1800/1900/3400/3700/3800 series
					—	NWS-721
NWP-516 NWU-C1950*3	20″ Color Display	1,280 × 1,024	480 × 476 × 535	38.5	NWB-225A	NWS-1410, 1510, PWS-1630, NWS-800/900/1700/1800/1900/3800 series
					NWB-225A (with NWB-280)	PWS-1630, NWS-800/900/1700/1800/1900/3800 series
					NWB-251	NWS-1410, 1510, PWS-1630, NWS-1700/1800/1900/3400/3700/3800 series
					—	NWS-721
NWP-5001	VECTRON	13,600 × 9,600	1,040 × 1,458 × 763	120	NWB-232A (GP-IB)	All except for the NWS-700, 1400, 3400 and 1500 series when using GP-IB. If connected through RS-232C, all the NEWS series can be used (except 700 series).
NWE-501*1	19″ Monochrome Display	1,024 × 768	452 × 368 × 381	16.4	NWB-253	NWS-3400 series
					—	NWS-1520 only
NWU-350*2	19″ Grayscale Display	1,280 × 1,024	468 × 402 × 402	13.6	NWB-225A	NWS-1510, NWS-800/900/1700/1800/1900 series
					NWB-225A (with NWB-280)	NWS-800/900/1700/1800/1900/3800 series
					NWB-251	NWS-1510/1700/1800/1900/3400/3700/3800 series
					—	NWS-721
NWP-517	15″ X terminal	1,280 × 960	393 × 381 × 413	14.9 (1.6kg: keyboard)	—	All except for NWS-711.
NWP-518	17″ Monochrome Display	1,024 × 768	413 × 417 × 371	Approx. 15.0	—	NWS-1450
					NWB-518	NWS-1410, NWS-1510, PWS-1630, NWS-1700, 1800, 1900, 3700, 3800 series
					NWB-253	NWS-3400 series
NWP-519 NWU-C1605*3	17″ Color Display 16″ Color Display	1,024 × 768	406 × 406 × 450	—	PWS-1560, NWS-1460, NWS-1530/80	
					NWB-254	NWS-1700/1800/1900/3400/3700/3800 series

Note: The display size indicates the physical dimensions of the CRT. To get the visual size, subtract one inch from the physical size.

*1: NWE-501 is available only in Europe. Original product by SMSE

*2: NWU-350 is available in the USA and Europe. Original product by SMSC

*3: "NWU-" models are available in USA

NWP-517 X Terminal

Major specification

		NWP-517
Processor	CPU	MC68000 (12.5MHz)
	Image Processor	TMS 34010
Memory	Main Memory	Standard 1.0 MB (Expandable up to 5.0 MB using NWA-028)
Monitor	CRT	15″ landscape, FS Tube, Bit map, Paper white (Phospher 192), Non Interlaced, Non glared
	Resolution	1280 × 960 dot
	Screen Size	260 × 195 (mm)
	Mechanism	Tilt ± 30 degrees Swivel ± 45 degrees
Input Devices	Keyboard	104 keys, 86 main keys, supplied with three-button mouse, detached, adjustable tilt (3 steps)
Communication Port	Type	Full duplex asynchronous/local echo (selectable) Full duplex/half duplex modem control
	Interface	EIA RS-232C, RS-422, RS-423
	Speed	300, 600, 1200, 4800, 9600, 19200, 38400 (bps)
	Bit length	7 bits or 8 bits (Stop bit 1 or 2 bits)
	Parity	Even/Odd/Non-Parity, Mark (7 bits), Space (7 bits)
	Protocol	XON/XOFF
	Control Code	ASCII, ANSII X3.64, JIS C 6220, JIS C 6226
Communications	Ethernet Module	IEEE802.3
	Interface	AUI Thick (10 BASE 5)
	Speed	10 (Mbps)
	Protocol	TCP/IP
Software	X Window System	Based on Version 11 Release 4
	TELNET	Based on Version RFC 854
Environmental Operating Range	Temperature	10 ~ 35°C
	Humidity	30 ~ 70% (noncondensing)
	Safety Standard	VCCI 1
Dimensions	Monitor and Base	393 × 381 × 413 mm (H × W × D)
	Keyboard	397 × 434 × 174 mm (H × W × D)
Weight	Monitor Base	14.9kg
	Keyboard	1.6kg
Optional Accessories		4 MB Expansion RAM Kit (NWA-028)

1.6.5. Printers and image readers

Here we offer a description of our laser beam printers and image readers, output and input devices which are indispensable for text and image processing.

1) Five printer models are available.

NWP-533 A4 size, Laser Beam Printer

NWE-101*1 A4 size, Laser Beam Printer

NWP-537 B4/A4 size, Laser Beam Printer

NWP-543 A3 size, Laser Beam Printer

NWP-549 B4/A4 size, Color Printer

NWE-111*3 B4/A4 size, Color Printer

Their specifications are summarized below:

	NWP-533/ NWE-101*1	NWP-537	NWP-543	NWP-549/ NWE-111*3
Paper size	A4	B4/A4	A3/A4/B4/B5	B4/A4/Postcard
Scanning density	400 DPI			300 DPI
Printing speed	8 pages (A4) per minute	6.7 pages (B4) per minute	16 pages (A4) per minute	6.25m sec/line
Interface	Video Interface			Centronics Parallel (8 bit)
Weight	Approx. 19 kg	Approx. 23 kg	Approx. 100 kg	Approx. 18 kg
Toner cartridge	NWA-017	NWA-019	—	Supplied goods are supplied through Seiko Instruments
Interface Board	NWB-240A (2MB Image buffer) NWB-242 (Image Board)	NWB-241A (3MB Image buffer) NWB-243 (8MB Image buffer)	NWB-243 (8MB Image buffer)	—

*1 NWE-101 is equivalent to NWP-533 and is available only in Europe.

*3 NWE-111 is equivalent to NWP-549 and is available only in Europe.

2) Five image reader models are available.

NWP-534

NWE-105*2

NWP-540

NWP-544

NWP-548

The following table compares their specifications:

	NWP-534/ NWE-105*2	NWP-540	NWP-544	NWP-548
Original size	Maximum 216 × 297 mm (A4)		Max. 420 × 297 mm (A3)	Max. 216 mm × 297 mm (A4/US Letter)
Read density	300 × 300 DPI (max.)	400 × 400 DPI (max.)		300 DPI (max.)
Scanning time	20.4 seconds (A4, 1 × magnification)	6.3 seconds (A4, 1 × magnification)	2.5 second (A4, 1 × magnification)	9 minutes (A4, 300 dpi)
Interface	8-bit, 2-way parallel TTL level	Video Interface		SCSI
Weight	Approx. 10 kg	Approx. 11 kg	Approx. 32 kg	Approx. 9 kg
Interface Board	NWB-240A (2MB Image buffer) NWB-241A (3MB Image buffer)	NWB-242 (Image Board) NWB-243 (8MB Image buffer)	NWB-243 (8MB Image buffer)	—
Option	—	NWA-031 (Document feeder)	NWA-036 (Document feeder)	—

*2 NWE-105 is an equivalent to NWP-534 and available only in Europe.

Note: Board-Peripheral Relationship Table

	Printer			Image Reader			Suitable NEWS Series
	NWP-533/ NWE-101*1 A4, L, B, P	NWP-537 B4.L.B.P.	NWP-543 A3.L.B.P.	NWP-534/ NWE-105*2	NWP-540	NWP-544	
NWB-240A	○			○			For all except 700 Series
NWB-241A		○		○			
NWB-242	○				○		
NWB-243		○	○		○	○	

1.6.6. Extended storage devices

The extended storage devices are all designed to be controlled by the SCSI (Small Computer System Interface) interface bus.

SCSI is a 8-bit parallel interface bus that conforms to ANSI specification X3T9.2. Up to eight SCSI controllers can be connected in a single system. The expansion units for the NEWS system each have their own SCSI controllers built in. In addition the network station itself and its internal hard disk are also equipped with a controller. An internal streaming tape unit, if installed, also is equipped with a controller. This means that a network station with an internal hard disk can be connected with a maximum of six expansion units (five if it is also equipped with a streaming tape unit).

The SCSI controllers are each assigned unique SCSI bus addresses. This allows the units to be connected daisy chain fashion without problems.

When connecting more than one expansion unit, care should be taken not to assign more than one unit to the same address.

At present, SCSI bus addresses are assigned as follows.

SCSI bus address	Comment
0	Not available (used by internal hard disk)
1	(Hard disk drive factory setting)
2	
3	
4	(MO disk unit factory setting)
5	(Internal streaming tape unit address, factory setting)
6	(DAT factory setting)
7	Not available (address of work station system unit)

A description of the hard disk drive, streaming tape unit and MO disk drive follows.

1) Hard disk unit

The following five models are available:

NWP-532 156 MB capacity (when formatted)

NWP-535 286 MB capacity (when formatted)

NWP-535A* 286 MB capacity (when formatted)

NWP-545 640 MB capacity (when formatted)

NWP-547 240 MB capacity (when formatted)

Features

All expansion hard disk drives except NWP-547 are high speed 5.25″ (3.5″ for NWP-547) Winchester type magnetic internal disk drives.

The formatted storage capacity of these units are 156MB, 240MB, 286MB and 640MB. And their average seek time of approximately 16.5 ms is outstanding for a 5.25″ hard disk. They realize high capacity and high speed access.

Using the SCSI interface makes it possible to handle the sectors on the disk as logical addresses. A wide range of SCSI functions is supported. In addition to a reselection system, they feature internal cache memory for consistently high system throughput and lightning fast data recording. The automatic bad sector alternation logic feature dramatically reduces wear and tear on the host system's software.

Major specifications

	NWP-532	NWP-535, NWP-535A	NWP-545	NWP-547
Total Memory capacity	156 MB (formatted)	286 MB (formatted)	640 MB (formatted)	239.6 MB (formatted)
Sector size	512 bytes			
Seek time	16ms (ave.) 40ms (max.) 4ms (min.)			16ms (ave./Reading) 20ms (ave./Writing) 40ms (max.) 7ms (min.)
Data Transfer rate (SCSI)	1.25 ~ 1.55 M bytes/sec.		1.5 ~ 4.0 Mbytes/sec.	
Start time	35 sec. (max.)	39 sec. (max.)	Approx. 35 sec.	
Dimensions (w/h/d)	160 × 100 × 370 mm (177.5 × 135 × 311.5 mm for NWP-535A)		177.5 × 135 × 311.5 mm	177.5 × 100 × 305.5 mm
Weight	Approx. 6.6 kg		Approx. 6.5 kg	Approx. 4 kg

Note: *NWP-535A is the hard disk unit designed for European specifications.

2) Streaming tape unit

The following two models are available:

NWP-531 60MB capacity

NWP-536 125MB capacity

NWP-536A* 125MB capacity

NWP-546 150MB capacity

Features

The NWP-531, NWP-536, NWP-536A and NWP-546 streaming tape unit are the cartridge tape decks designed for use with the Sony NEWS series NETWORK STATIONs.

• Large recording capacity

The NWP-531 can record 60 Mbytes. The NWP-536 and NWP-536A can record 125 Mbytes of data into a 1/4-inch data cartridge using a 600-foot tape. The NWP-546 can record 150 Mbytes of data.

• SCSI interface

For the interface with the NEWS system, SCSI (Small Computer System Interface) is employed. Therefore, you can handle the data in the cartridge tape as batches of logic block addresses, regardless of the data format. Most of the SCSI's functions are supported, including reselection.

• High-speed data recording

The unit is equipped with a cache memory and can record data without reducing the throughput of the system.

Employing the tape streaming mode, it is capable of high-speed data recording.

• Low error rate

With its automatic retrial function to correct write errors and its error correcting codes, this unit is highly reliable as a data recorder, having a non-recoverable error rate of less than 10^{-11}.

• Broad compatibility

Using the common QIC format for data recording, the unit has broad compatibility with other tape drives. It can be used not only for file back-up in the NEWS system but also for data communication with other systems.

Major specifications

	NWP-531	NWP-536, NWP-536A	NWP-546
Max. capacity	60 MB	125 MB	150 MB
Read error rate Recoverable error Non-recoverable error	 not more than 10^{-8} not more than 10^{-10}	 not more than 10^{-8} not more than 10^{-11}	 not more than 10^{-8} not more than 10^{-10}
Data transfer rate	90 Kbytes/sec		112.5 Kbytes/sec
Data transfer rate (user)	1.25 Mbytes/sec	1.8 Mbytes/sec	
Data block capacity	512 bytes (fixed)		
Data buffer size	approx. 14 Kbytes	64 Kbytes	32 Kbytes
Head format	Read after write/erase		
Reading tracks	9 tracks, serpentine	15 tracks, serpentine	15/18 tracks, serpentine
Media	1/4-inch, 600-foot 1/4-inch, 450-foot	1/4-inch, 600-foot	1/4-inch, 600-foot 1/4-inch, 450-foot
Tape speed	90 inches/sec	72 inches/sec	90 inches/sec
Recording code	GCR	RLL (0.2)	GCR
Recording format	QIC-24 (read/write) QIC-11 (read/write)	QIC-120 (read/write) QIC-24 (read only)	QIC-150 (read/write) QIC-120 (read/write) QIC-24 (read only)
Recording Density	10,000 bit/inch	12,500 bit/inch	10,000 bit/inch
Start/Stop time	300 millisec. max		
Capacity (formatted)	DC300XL: 45 Mbytes DC600A: 60 Mbytes DC600XTD: 60 Mbytes	DC600A: 125 Mbytes DC600XTD: 125 Mbytes	DC600A: 120/60 Mbytes **DC6150: 150/120 Mbytes
Dimensions	160 × 100 × 370 mm (w/h/d) excluding projecting parts	(177.5 × 100 × 305.5 mm for NWP-536A)	177.5 × 100 × 305.5 mm
Weight	Approx. 4.9 kg		Approx. 3.7 kg

Note: *NWP-536A is the streaming tape unit designed for European Specifications.
**DC6150 tape is required for recording in the QIC-150 format.

Relation of Model and Recording Format

	NWP-531	NWP-536/536A	NWP-546
QIC-11	○		
QIC-24	○	△	△
QIC-120		○	○
QIC-150			○

○ : read/write capable
△ : read only
blank: not supported

3) MO disk unit

NWP-539N* (Vertical Type)

NWP-559 (Horizontal Type)

Features

- Magneto-Optical recording system allows data to be erased and written to disk a virtually unlimited number of times.
- The two sides of a single 130mm (5.25″) diameter magneto-optical disk can store up to 594 Mbytes (512 bytes/sector). This is equivalent to the storage capacity of approximately 500 floppy disks (5.25 inch, 2HD).
- The disks conform to the worldwide ISO Continuous/Composite Servo (CS) format standard.
- The SCSI interface is used, allowing easy connectability with NEWS.
- High speed spindle motor (2400 rpm) makes for a fast data transfer rate of 620 Kbytes per second.
- Thin, lightweight laser pickup boasts an average seek time of 95 msec.
- Highly reliable error correction function (Long Distance Code) makes for an ultra-low error rate of 10^{-12}.

Major specifications

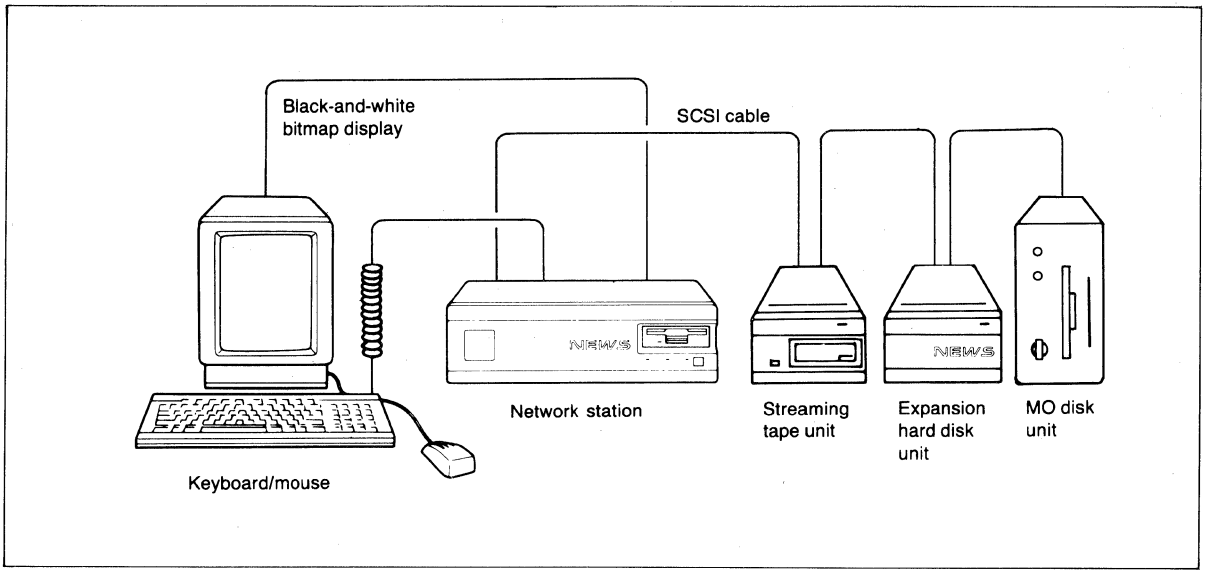
	NWP-539N	NWP-559
Storage Media MO disk EDM-1DA1 Cartridge type	31 sectors/track. 512B/sector. 18751 track/side (ISO format) 130 mm (5.25″)	
Unit Storage capacity (formatted) Disk (both sides) One side	 594 Mbytes (format) 297 Mbytes (format)	 592 Mbytes (format) 297 Mbytes (format)
Total storage capacity (unformatted) One side	433.6 Mbytes (format)	
Rotational speed	2400 rpm (CAV)	
Average rotational wait time	12.5 msec.	
Seek time (not including rotational wait time and SCSI overhead) 1 track Short stroke (±64 tracks) Average Maximum	 10 msec (average) 22 msec (average) 95 msec (average) 185 msec (average)	
Data transfer rate	7.40 Mbytes/sec	
User data transfer rate Continuous transfer rate Burst transfer rate	 620 Kbytes/second (format) 1.2 Mbytes/second (max.)	
Loading time	5.2 seconds (average)	6.4 sec (average)
Unloading time	2.8 seconds (average)	3.6 sec (average)
Bias magnet rotation time	12 msec (average)	18 msec (average)
Host interface	SCSI (Small Computer System Interface) ANSI X3.131-1986, CCS Rev. 4B	
Dimensions (W × H × D)	126 × 211 × 310mm	
Weight	excluding projecting parts 6.5 kg	

Note: The NWA-032 interface kit is available for connecting the NWP-539N to PC-9801 series computers.

*NWP-539N is the MO disk drive available only in Japan.

System configuration employing the SCSI interface

Example of system configuration



Notes: Use NWA-034 SCSI cable for connecting.
A SCSI terminator (included) is required.
No terminator is used in the above example because the MO disk unit employs a function enabling it to emulate a terminator by setting a dip switch.

4) DAT Data Storage Unit

NWP-542

Features

The DAT (Digital Audio Tape) Data Storage Unit is a large scale capacity (1.3 GB with a 120 minute DDS data cartridge) and high performance data storage unit based on the DDS (Digital Data Storage) format. Sony's expertise in DAT helical-scan recording technology as an inventor has been enhanced further to provide high reliability and performance as a computer data storage device. The NWP-542 is suitable for high capacity data and software back-ups, data and software distributions, archival mass storage, etc. With its read-after-write function and third level error correction coding, NWP-542 assures the highest data integrity. The unit is interfaced with NEWS through SCSI interface.

- Large 1.3GB of storage capacity on a 60M DDS data cartridge (DG-60M), considerably smaller than a standard audio cassette.
- 183KB per second of high data transfer rate.
- Read-after-write and multiple group writing.
- Uncorrectable error-rate less than 10^{-15} (Third level error correction).
- SCSI Sequential Access Comand sets compatible.

Major specifications

	NWP-542
Capacity	1.3 GB (max.)
Nominal transfer rate	183 KB (max.)
Linear recording density	61,000 bits per inch
Recording method	8 to 10 modulation
Recording length	variable
Random access time	20 seconds with 1.3 GB tape
Search speed	approx. 200 times nominal
Drum rotational speed	2,000 rpm
Drum diameter	30 mm
Number of drum heads	4
Interface	SCSI-1 Sequential Access Command sets compatible
Uncorrectable error-rate	less than 1 in 10^{-15} bits
Power consumption	40W
Dimensions (W × H × D)	177.5 × 100 × 375.3 mm ($6\frac{1}{2} \times 3\frac{9}{10} \times 16\frac{6}{10}$")
Weight	5.6 kg

Storage Media

Model No.	Name/Description	Capacity	Media Dimensions (W × H × D)
DG-5CL	DDS Data Cartridge Cleaning Tape	—	73 × 54 × 10.5 mm ($2\frac{7}{15} \times 2\frac{1}{4} \times \frac{7}{16}$")
DG-60M	DDS Data Cartridge (Approx 60 meters)	1.3 GB	73 × 54 × 10.5 mm ($2\frac{7}{15} \times 2\frac{1}{4} \times \frac{7}{16}$")
DG-30M	DDS Data Cartridge (Approx 30 meters)	0.65 GB	73 × 54 × 10.5 mm ($2\frac{7}{15} \times 2\frac{1}{4} \times \frac{7}{16}$")

Caution

Although it is possible to use an audio DAT, in order to assure best performance, a Sony's DDS data cartridge is highly recommended.

1.7 Boards

Boards are discussed grouped separately by function. Also see Table 1.9-1 NEWS Products-Interrelationship Table and figure 1.9-1 NEWS Products-Interrelationship Figure.

1.7.1. Internal memory expansion boards

Board	Name	Comment
NWB-108	8 MB Expansion RAM Board	For the NWS-800/900 series
NWB-109	16 MB Expansion RAM Board	For the NWS-1800/1900/3800*1 series
NWB-110	Expansion RAM Board	For the NWS-1600/1700 series/install the NWA-029 (4 MB expansion RAM kit)
NWB-112	64 MB Expansion RAM Board	For NWS-3860/3840
NWB-112A	64 MB Expansion RAM Board	For NWS-3800 series

Notes: To expand the memory of the NWS-700/1500 series, use NWA-028 (4MB expansion RAM kit).
The above expansion boards are installed directly on the motherboard (MPU board) of the system unit.
*1: NWB-109 can not be used for NWS-3870/3865.

1.7.2. Boards for expansion slots

1) Display boards

Board	Name	Comment
NWB-512	Monochrome Bitmap Interface	For the NWP-512D
NWB-514	Grayscale Bitmap Interface	For the NWP-514
NWB-518	Monochrome Bitmap Interface	For the NWP-512D/518, NWE-501
NWB-225A	Color Bitmap Interface	For the NWP-513/516, NWU-350*2
NWB-280	4-Plane Color Expansion	Expands the functions of the NWB-225A
NWB-251	Color Bitmap Interface	For the NWP-513/516, NWU-350*2
NWB-252	Color Bitmap Interface	For the NWP-515/519, NWS-3400 series only.
NWB-253	Monochrome Bitmap Interface	For the NWP-512D, NWE-501*1 NWP-518, NWS-3400 series only.
NWB-254/254P	Videomap Display Interface	For the NWP-515/519.
NWB-255	Monochrome Bitmap Interface	For the NWP-514. NWS-3400 series only.

Note: Limitations apply when connecting some boards to a NEWS system unit. See table 1.9-1.
*1: NWE-501 is available only in Europe.
*2: NWU-350 is available only in USA, Europe.

• **NWB-254/254P** Videomap Display Interface Board

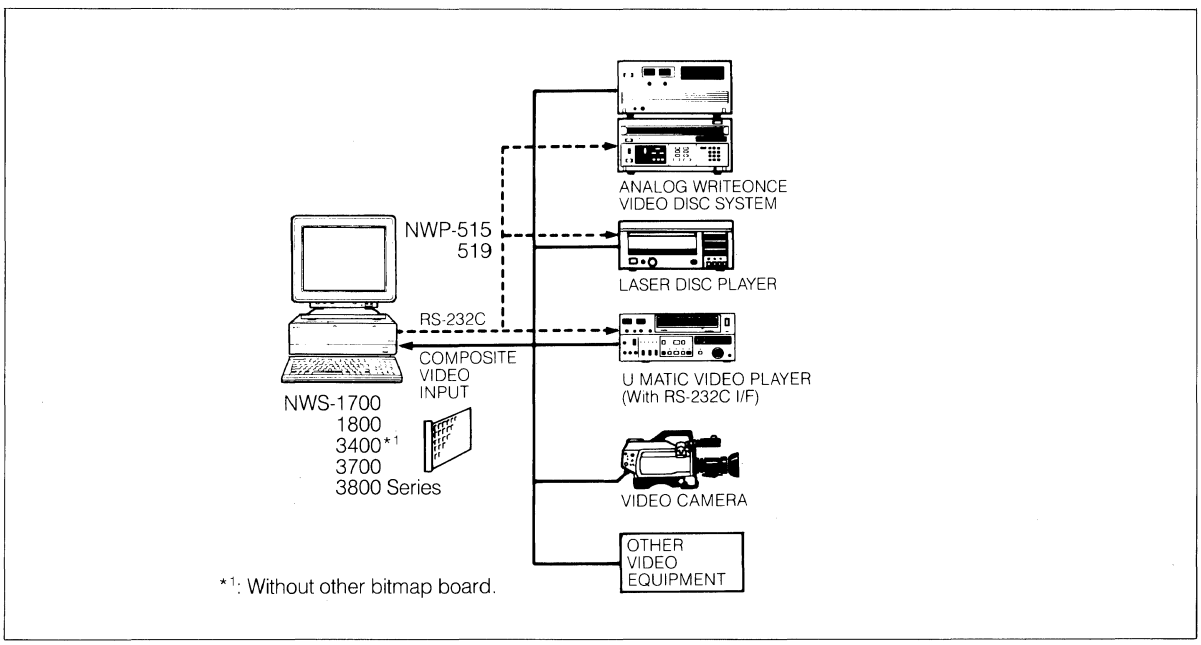
Developed for use in NEWS workstation, the NWB-254/254P is a Videomap Display Interface board.

The NWB-254/254P videomap controller enables you to economically display realtime video in an X Window System on a NEWS Workstation. Fully integrated under X Window Version 11 Release 4, the variable video window may be sized from 160 × 120 (min./NTSC) to 640 × 480 (max./NTSC), or from 184 × 144 (min./PAL) to 736 × 576 (max./PAL) resolution, and placed anywhere on the screen. Variable frame rates are also supported from the standard NTSC 30 frames/sec or PAL 25 frames/sec, down to a single still frame. Combined with the audio capability that is standard on the NEWS workstations, the system is ideally suited for all UNIX desktop video and graphics applications, such as Computer Aided Instruction, Video Presentations, Process Monitoring and Control, Video Databases, Image and Video Index Systems and many other Multi-Media applications.

Major specifications

	NTSC	PAL
Screen Resolution	1024 × 768 pixel 48kHz (Horizontal) 60Hz (Vertical) Non-interlaced	
Frame Buffer	1024 × 1024 × 16 bits/pixel (5 bits each for R, G, B + 1 bit for Alpha) 32,768 simultaneous colors	
Video Interface	1 channel NTSC composite signal input 12.28MHz sampling frequency Frame freeze and capture capability	1 channel PAL composite signal input Approx. 14MHz sampling frequency
Live Video Window Size	160 × 120 (min.) to 640 × 480 (max.) pixel	184 × 144 (min.) 736 × 576 (max.) pixel
Supported platforms	NWS-1700/1800/3700/3800 NWS-3400 Series (without other bitmap board) Requires 1 slot only	

Sample Configuration



2) VMEbus boards

Board	Name	Comment
NWB-234A	VME Interface Board	Board used to connect system unit to NWP-413/414 VME boxes
NWB-224/224P	Full Color Video Graphic Interface Board	Installable in NWP-414
NWB-226	VTR Control Interface Board	Installable in NWP-414; effective when used with NWB-224/224P

Note: The sizes of the boards supported by the NWP-413 and NWP-414 VME boxes are different. For details, see the VME section of Chap. 4: I/O interface.
NWB-234A consists of 2 boards and 2 cables. The one of the board is "VMC" board to be inserted to VME box. The other is "VIF" board to be inserted to an expansion slot on NEWS system (for the NWS-800, 1700, 1800 series).

When Connecting NWS-900/1900 Series with NWB-224/226

Model	Board Connected	Adaptor
NWS-900 Series & NWS-1960	NWB-224/226	NWA-030
NWS-1930	NWB-224(P)/226	Optional double-height adaptors

Descriptions are given here of the NWB-224 and NWB-226.

- **NWB-224** full color video graphic interface board

Developed for use in NEWS series workstations, the NWB-224 is a frame memory board with video I/O facilities.

Using 8 bits to represent the red, green and blue(RGB) signals, the NWB-224 boasts a video plane capable of displaying a total of 16,70 million colors simultaneously, two character planes featuring a CLUT (Color Look Up Table) function and a cursor plane. The display area contains 768 × 480 pixels. NTSC/60Hz non-interlace switching is possible. A wide range of powerful image processing functions includes the ability to selectively display each frame and to combine them with external video signals.

The VME (Versa Module Europe) bus is used as the interface with the NEWS system workstation, making an array of image processing techniques possible. In order to connect the NWB-224 to a NEWS series workstation (selected models) an NWB-234A VME interface board and NWP-414 VME box (both sold separately) are required.

The above accessories also allow connection with a VTR and video camera (see connections diagram).

- **NWB-226** VTR control interface board

Developed for use in NEWS series workstations, the NWB-226 is a VTR controller board.

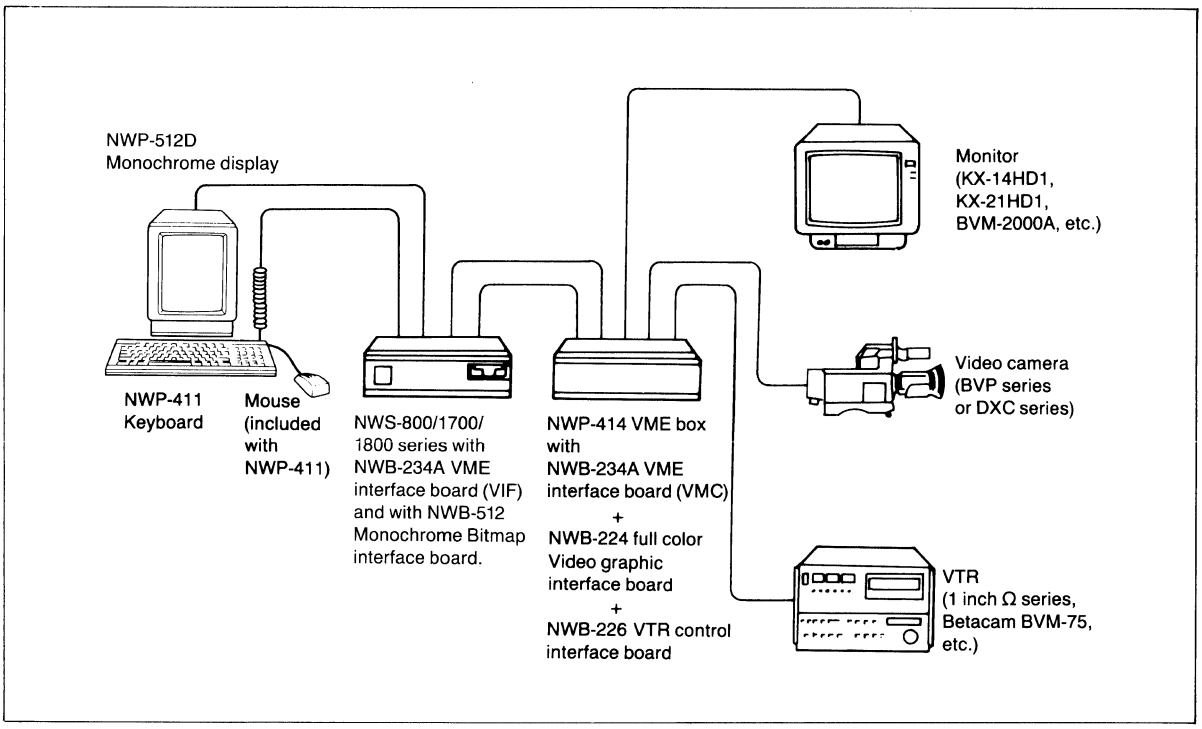
Once the NWB-226 is installed in a NEWS series workstation (selected models) playback, stop, record, edit and additional fuctions can be controlled in real time from the workstation.With the addition of the NWB-224 full color video graphic interface board, a wide array of video processing techniques become available, including the manipulation of video images which can be recorded on the VTR.

NEWS workstations with this board installed can control any VTR equipped with a standard RS-422 9-pin connector (such as the Sony BVH-2000, BVH-2500 or BVH-75; up to two units).

The VME (Versa Module Europe) bus is used as the interface with the NEWS system workstation.

A NWB-234A VME interface board and NWP-414 VME box (both sold separately) are required for connections with NEWS series workstations.

Example of system configuration including NWB-224 and NWB-226



3) Image processing boards

Board	Name	Comment
NWB-240A	LBP*/Image Reader Interface Board	Supports NWP-533 and NWP-534
NWB-241A	LBP*/Image Reader Interface Board	Supports NWP-537 and NWP-534
NWB-242	Image Board	Supports NWP-533 and NWP-540
NWB-243	Image Board	Supports NWP-543, NWP-544, NWP-537, NWP-540

*LBP: Laser Beam Printer

4) I/O port expansion boards

Board	Name	Comment
NWB-231A	4 channel Serial Interface Board	Maximum of two may be installed in one system unit; supports RS-232C or RS-422A port
NWB-232A	GP-IB Interface Board	Adds GP-IB × 1, RS-232C × 2, RS-422A × 1
NWB-235A	Expansion Network Board	Maximum of two may be installed in one system unit; adds one channel per board
NWB-238	Modem Board	For NWS-1200/3200 series. Designed based on Japanese Telecommunication standard. Transfer rate: 2400 bps. NWB-238 is built in only in Japan.
NWB-260	Audio Interface Board	

• **NWB-260** Audio Interface Board

The NWB-260 is an Audio Interface Board designed for sound recording and playback from an audio equipment or the supplied Microphone/speaker to the NEWS workstation. Using optional software, sound data for use with CD-ROM XA or CD-I (Level A, B and C) can be produced.

NWS-3400/3700/3800 series have a built-in Audio Interface Facility which equals to NWA-033, Audio Interface Kit. NWA-033 has the same functions as the NWB-260 except ADPCM realtime encoding.

To encode realtime ADPCM digital sound data, NWF-625 ADPCM Realtime Encoder is required.

Although NWS-1200/3200 series have a built-in audio interface which equals to NWA-033, NWB-260 can not be used because of the physical limitation of the expansion slot. For more detailed specification, please see the User's Guide of NWB-260.

Audio Interface Modes

When connected to the interface board, your workstation can handle the following data in stereo and mono:

Table 1. Data handled by workstation

Coding format	Word Length (bits per sample)	Sampling Frequency (kHz)			
		37.8	18.9	9.45	8.0
Straight PCM	16	○	○	○	○
Straight PCM	8	○	○	○	○
ADPCM*1	8	★	—	—	—
ADPCM	4	★	★	*	—
μ-law*2	8	○	○	○	○
A-law*2	8	○	○	○	○

○: recording and playback

★: recording and playback (Optional software necessary for recording. For enquiries about this software, contact your Sony dealer.)

*: playback only (Straight PCM data can be converted to ADPCM data using the supplied library with the operating system.)

—: recording/playback unavailable

*1 ADPCM (Adaptive Differential PCM):
One of the methods of compressing and expanding data.
Depending on sound quality and the amount of data, four types of ADPCM mode are available.

*2 μ-law, A-law:
Standard sound encoding method specified by CCITT. Encoding is usually performed at a sampling frequency of 8 kHz, but this board can operate at other sampling frequencies.

1.8 Accessories

Details on accessories are given at various places in other sections where appropriate and are therefore not repeated here.

The table below is provided as a convenient review of features.

Accessory	Name	Comment
NWA-011 ~ 016	RS-232C cable	Six varieties of RS-232C cable are available. For details, see Chap. 4.2.: Serial port.
NWA-017	EP-S cartridge	For the NWP-533
NWA-019	EP-T cartridge	For the NWP-537
NWA-021	Network Starter Kit	Ethernet cable (20m) ×1, transceiver ×2 Transceiver cable (5m) ×2, Terminator ×2
NWA-022	Transceiver kit	Additional connection with NWA-021
NWA-023	Transceiver installing jig	For the NWA-022
NWA-024	FDD cable	For the NWS-1500/1700 series
NWA-027	16MB Expansion RAM kit (with parity)	For the NWS-3700/3200 series.
NWA-028	4MB Expansion RAM kit	For the NWS-700/1200/1400/1500 and PWS-1500 sereis.
NWA-029	4MB Expansion RAM kit (with parity)	For the NWS-1700/3200/3400/3700 and PWS-1600 series.
NWA-030	Double height VME Board Adopter Set	Can be mounted on double height VME Board and installed in the NWS-900 series and NWS-1960.
NWA-031	Document Feeder	For the NWP-540
NWA-032	MO interface kit	For connecting NEC's PC-9801 series computer with NWP-539S/559.
NWA-033	Audio interface kit	For the NWS-1400/1500 series
NWA-034	SCSI cable	80 cm SCSI cable
NWA-036	Document Feeder	For NWP-544
NWA-018	Color Board Version-up Kit	For making NWB-223 be equivalent to NWB-225.
NWA-035	NEWS Rack	NEWS and external storage devices such as MO, DAT, HDD, etc., can be stored.
NWA-037	Carrying Case	Carrying Case (Hard-Type) for NWS-1200/3200 Series.
NWA-038	Carrying Bag	Carrying Bag (Soft-Type) for NWS-1200/3200 Series.
NWA-040	Pedestal	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-041	Paper Deck	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-042	Face Down Stacker	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-043	Mounting H/W for Pedestal	To mount NWA-042 (Face Down Stacker) to the Pedestal (NWA-040).
NWA-044	Duplex Printing Module	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-045	A4 Cassette	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-046	B4 Cassette	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-047	B5R Cassette	For NWP-543 B5 size, vertical (Laser Beam Printer, available only in Japan.).
NWA-048	B5 Cassette	For NWP-543 B5 size, horizontal. (Laser Beam Printer, available only in Japan.).

Accessory	Name	Comment
NWA-049	Toner	For NWP-543 (Laser Beam Printer, available only in Japan.).
NWA-050	Transceiver Kit	
NWA-051	Terminator Kit	For NWA-050 (Transceiver Kit).
NWA-052	Network Cable	5m network cable.
NWA-053	Network Cable	20m network cable.
NWA-054	European Keytop Set	For use with NWP-411A.
NWA-054LT	European Keytop Set	For NWS-1200/3200 Series.
NWA-055	Transceiver Cable	For NWA-050 (Transceiver Kit).
NWA-056	Printer Cable	For NWS-1200/3200 Series.
NWA-057	Printer Cable	For use with NWP-549, Color Printer.
PCZ-310T	SCSI Cable	For NWS-1200/3200 Series.

1.9 NEWS Products-Interrelationship

A systematic summary of the information up to this point is provided in table 1.9-1 NEWS Products-Interrelationship Table on the following page.

Connection compatible boards and systems (also peripherals and systems or accessories and systems) are marked with a ○.

A diagrammatical representation of the relationships listed in the table is given in figure 1.9-1 NEWS Products-Interrelationship Figure.

The board/interface/system combinations listed are current as of the date of publication.

Table 1.9-1
NEWS Products-Interrelationship Table-①-1

Mark ○ indicates the possibility of connection.
Note that some boards may not be directly plugged in the main unit's expansion slot.

				• MPU Board	MPU-4	MPU-6		MPU-2			MPU-3		Modified MPU-3		MPU-7										MPU-8				MPU-5					MPU-13	
				• NEWS Series	700 Series			800 Series					900 Series		1400 Series			1500 Series								1600 Series	1700 Series			1800 Series			1900 Series		1200 Series	
				• Model Name	NWS-711	NWS-712	NWS-721	NWS-811	NWS-891	NWS-821	NWS-831	NWS-841	NWS-911	NWS-921	NWS-1410	NWS-1450	NWS-1460	NWS-1510	NWS-1520	NWS-1530	NWS-1580	PWS-1520	PWS-1550	PWS-1560	PWS-1630	NWS-1710	NWS-1720	NWS-1750	NWS-1830	NWS-1850	NWS-1860	NWS-1930	NWS-1960	NWS-1230	NWS-1250
					(UC, J)	(EK)	(UC) (EK) (J)	(J)	(J)	(J)	(J)	(UC, J)	(J)	(J)	(J)	(J)	(J)	(EK)	(EK)	(EK)	(EK)	(J)	(J)	(J)	(J)	(UC)	(UC) (EK) (J)	(UC) (EK) (J)	(UC) (EK) (J)	(UC) (EK) (J)	(J)	(UC, EK)	(J)	(J)	(EK, J)
Expansion RAM Board	**NWB-108**[*1] 8MB Expansion RAM Board										○	○	○	○																					
	NWB-109[*1] 16MB Expansion RAM Board																													○	○	○	○	○		
	NWB-110[*2] Expansion RAM Board																								○	○	○	○							
	NWB-112 64MB Expansion RAM Board																																		
	NWB-112A 64MB Expansion RAM Board																																		
Expansion RAM Kit	**NWA-027**[*3] 16MB Expansion RAM kit (with parity)																																		
	NWA-028[*3] 4MB Expansion RAM kit					○	○								○	○	○	○	○	○	○	○	○	○									○	○
	NWA-029[*3] 4MB Expansion RAM kit (with Parity)																								○	○	○	○							
Audio Interface Kit	**NWA-033**														○	○	○	○	○	○	○	○	○	○											
VME Board	**NWB-224/244P**[*4] Full Color Video Graphic I/F Board	**NWP-414** VME Box	**NWB-234A** VME I/F Board					○	○	○	○	○													○	○	○	○	○	○	○				
	NWB-226 VTR Control I/F Board	**NWP-414** VME Box	**NWB-234A** VME I/F Board					○	○	○	○	○													○	○	○	○	○	○	○				
	NWB-224/224P Full Color Video Graphic I/F Board	**NWA-030** Double Height VME Board Adapter Set											○	○																	○	○		
	NWB-226[*5] VTR Control Interface Board	**NWA-030** Double Height VME Board Adapter Set											○	○																	○	○		
	NWB-234A VME Interface Board	**NWP-413/414**[*6] VME Box							○	○	○	○	○													○	○	○	○	○	○				

Notes: [*1] • These boards are directly plugged in on the MPU board.
[*2] • NWA-029 to be mounted.
[*3] • Can be added to internal board.
[*4] • NWA-030 is required (Double height VME board adapter set).
• Can be plugged in NWP-414.
[*5] • The combined use with NWB-224/224P is more effective.
[*6] • Communication board plugged in the main unit and VME box.
• VIF board to main unit. VMC board to VME box.
• NWP-414 is a VME box used exclusively for NWB-224 and NWB-226.

Table 1.9-1
NEWS Products-Interrelationship Table-①-2

Mark ○ indicates the possibility of connection.
Note that some boards may not be directly plugged in the main unit's expansion slot.

				• MPU Board	MPU-16			MPU-12					MPU-15							MPU-10				
				• NEWS Series	3200 Series			3400 Series					3700 Series							3800 Series				
				• Model Name	NWS-3250 (Type D)	NWS-3250 (Type F)	NWS-3260	NWS-3410	NWS-3410 (Type A)	NWS-3410 (Type D)	NWS-3410 (Type E)	NWS-3460	NWS-3710 (Type A)	NWS-3710 (Type D)	NWS-3710 (Type F)	NWS-3720	NWS-3720 (Type A)	NWS-3720 (Type G)	NWS-3720 (Type I)	NWS-3840	NWS-3860	NWS-3865 (Type E)	NWS-3865 (Type G)	NWS-3870
					(UC)	(UC)	(J/EK)	(J)	(EK)	(EK)	(EK)	(J)	(UC)	(UC)	(UC)	(J)	(EK)	(EK)	(EK)	(J)	(J/EK)	(EK)	(EK)	(J)
Expansion RAM Board	**NWB-108**[*1] 8MB Expansion RAM Board																							
	NWB-109[*1*3] 16MB Expansion RAM Board																			○	○			
	NWB-110[*2] Expansion RAM Board																							
	NWB-112[*3] 64MB Expansion RAM Board																			○	○			
	NWB-112A[*4] 64MB Expansion RAM Board																			○	○	○	○	○
Expansion RAM Kit	**NWA-027**[*5] 16MB Expansion RAM kit (with parity)				○	○	○									○	○	○	○					
	NWA-028[*5] 4MB Expansion RAM kit																							
	NWA-029[*5] 4MB Expansion RAM kit (with Parity)				○	○		○	○	○	○	○	○	○	○									
Audio Interface Kit	**NWA-033**																							
VME Board	**NWB-224/244P**[*6] Full Color Video Graphic I/F Board	**NWP-414** VME Box	**NWB-234A** VME I/F Board																					
	NWB-226 VTR Control I/F Board	**NWP-414** VME Box	**NWB-234A** VME I/F Board																					
	NWB-224/224P Full Color Video Graphic I/F Board	**NWA-030** Double Height VME Board Adapter Set																						
	NWB-226[*7] VTR Control Interface Board	**NWA-030** Double Height VME Board Adapter Set																						
	NWB-234A VME Interface Board	**NWP-413/414**[*8] VME Box																						

Notes:
[*1] • These boards are directly plugged in on the MPU board.
[*2] • NWA-029 to be mounted.
[*3] • NWB-112, NWB-109 can not be used for NWS-3870, 3865.
[*4] • NWB-112A is for NWS-3800 Series.
[*5] • Can be added to internal board.
[*6] • NWA-030 is required (Double height VME board adapter set).
• Can be plugged in NWP-414.
[*7] • The combined use with NWB-224/224P is more effective.
[*8] • Communication board plugged in the main unit and VME box.
• VIF board to main unit. VMC board to VME box.
• NWP-414 is a VME box used exclusively for NWB-224 and NWB-226.

Table 1.9-1
NEWS Products-Interrelationship Table-②-1

Mark ○ indicates the possibility of connection.
Note that some boards may not be directly plugged in the main unit's expansion slot.

			• MPU Board	MPU-4	MPU-6		MPU-2			MPU-3		Modified MPU-3		MPU-7									MPU-8				MPU-5					MPU-13	
			• NEWS Series	700 Series			800 Series					900 Series		1400 Series			1500 Series							1600 Series	1700 Series			1800 Series			1900 Series		1200 Series	
			• Model Name	NWS-711	NWS-712	NWS-721	NWS-811	NWS-891	NWS-821	NWS-831	NWS-841	NWS-911	NWS-921	NWS-1410	NWS-1450	NWS-1460	NWS-1510	NWS-1520	NWS-1530	NWS-1580	PWS-1520	PWS-1550	PWS-1560	PWS-1630	NWS-1710	NWS-1720	NWS-1750	NWS-1830	NWS-1850	NWS-1860	NWS-1930	NWS-1960	NWS-1230	NWS-1250
				(UC, J)	(EK)	(UC) (EK) (J)	(J)	(J)	(J)	(J)	(UC, J)	(J)	(J)	(J)	(J)	(J)	(EK)	(EK)	(EK)	(EK)	(J)	(J)	(J)	(J)	(UC)	(UC) (EK) (J)	(UC) (EK) (J)	(UC) (EK) (J)	(UC) (EK) (J)	(J)	(UC, EK)	(J)	(J)	(EK, J)
Display																																		
NWB-225A Color Bitmap Interface Board	**NWP-513/NWU-C1601**[*1]	17″ Color Display					○	○	○	○	○	○	○	○			○							○	○	○	○	○	○	○	○	○		
	NWP-516/NWU-C1950[*2]	20″ Color Display					○	○	○	○	○	○	○	○			○							○	○	○	○	○	○	○	○	○		
	NWU-350[*3]	19″ Grayscale Display					○	○	○	○	○	○	○	○			○							○	○	○	○	○	○	○	○	○		
NWB-225A with NWB-280[*4] Color Bitmap Interface Board with 4 Plane Color Expansion	**NWP-513/NWU-C1601**[*1]	17″ Color Display					○	○	○	○	○	○	○											○	○	○	○	○	○	○	○	○		
	NWP-516/NWU-C1950[*2]	20″ Color Display					○	○	○	○	○	○	○											○	○	○	○	○	○	○	○	○		
	NWU-350[*3]	19″ Grayscale Display					○	○	○	○	○	○	○											○	○	○	○	○	○	○	○	○		
NWB-251 Color Bitmap Interface Board	**NWP-513/NWU-C1601**[*1]	17″ Color Display												○			○							○	○	○	○	○	○	○	○	○		
	NWP-516/NWU-C1950[*2]	20″ Color Display												○			○							○	○	○	○	○	○	○	○	○		
	NWU-350[*3]	19″ Grayscale Display												○			○							○	○	○	○	○	○	○	○	○		
NWB-252 Color Bitmap Interface Board	**NWP-515**	14″ Color Display																																
	NWP-519	17″ Color Display																																
NWB-253[*11] Monochrome Bitmap Interface Board	**NWP-512D**	15″ Monochrome Display																																
	NWP-518	17″ Monochrome Display																																
	NWE-501[*6]	19″ Monochrome Display																																
NWB-254/254P Videomap Display Interface Board	**NWP-515**	14″ Color Display																							○	○	○	○	○	○	○	○		
	NWP-519	17″ Color Display																							○	○	○	○	○	○	○	○		
	NWU-C1605[*7]	16″ Color Display																							○	○	○	○	○	○	○	○		
NWB-255	**NWP-514**	19″ Grayscale Display																																
NWB-512[*11] Monochrome Bitmap Interface Board	**NWP-512D**	15″ Monochrome Display					○	○	○	○	○	○	○	○			○							○	○	○	○	○	○	○	○	○		
NWB-514 Grayscale Bitmap Interface Board	**NWP-514**	19″ Grayscale Display												○			○							○	○	○	○	○	○	○	○	○		
NWB-518[*11] Monochrome Bitmap Interface Board	**NWP-518**	17″ Monochrome Display												○										○	○	○	○	○	○	○	○	○		
	NWP-512D/NWU-M19[*5]	15″ Monochrome Display												○										○	○	○	○	○	○	○	○	○		
NWB-232A GPIB	**NWP-5001**	VECTRON					○	○	○	○	○	○	○											○	○	○	○	○	○	○	○	○		
Unnecessary	**NWP-511F**[*8]	Kanji Terminal					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWP-517	X-terminal	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWP-512D[*9]	15″ Monochrome Display		○											○			○			○	○												
	NWP-515[*9]	14″ Color Display														○			○	○			○											
	NWE-501[*6]	19″ Monochrome Display															○																	
	NWP-518	17″ Monochrome Display													○																			
	NWP-519	17″ Color Display														○			○	○			○											
	NWP-513[*10]	17″ Color Display			○																													
	NWP-516[*10]	20″ Color Display			○																													
	NWU-350[*3]	19″ Grayscale Display			○																													

* -See the NOTE on the next page.

Table 1.9-1
NEWS Products-Interrelationship Table-②-2

Mark ○ indicates the possibility of connection.
Note that some boards may not be directly plugged in the main unit's expansion slot.

			• MPU Board	MPU-16			MPU-12					MPU-15							MPU-10				
			• NEWS Series	3200 Series			3400 Series					3700 Series							3800 Series				
			• Model Name	NWS-3250 (Type D)	NWS-3250 (Type F)	NWS-3260	NWS-3410	NWS-3410 (Type A)	NWS-3410 (Type D)	NWS-3410 (Type F)	NWS-3460	NWS-3710 (Type A)	NWS-3710 (Type D)	NWS-3710 (Type F)	NWS-3720	NWS-3720 (Type A)	NWS-3720 (Type G)	NWS-3720 (Type I)	NWS-3840	NWS-3860	NWS-3865 (Type E)	NWS-3865 (Type G)	NWS-3870
				(UC)	(UC)	(J/EK)	(J)	(EK)	(EK)	(EK)	(J)	(UC)	(UC)	(UC)	(J)	(EK)	(EK)	(EK)	(J)	(J/EK)	(EK)	(EK)	(J)
Display																							
NWB-225A Color Bitmap Interface Board	**NWP-513/NWU-C1601**[*1]	17″ Color Display																	○	○	○	○	○
	NWP-516/NWU-C1950[*2]	20″ Color Display																	○	○	○	○	○
	NWU-350[*3]	19″ Grayscale Display																	○	○	○	○	○
NWB-225A with NWB-280[*4] Color Bitmap Interface Board with 4 Plane Color Expansion	**NWP-513/NWU-C1601**[*1]	17″ Color Display																	○	○	○	○	○
	NWP-516/NWU-C1950[*2]	20″ Color Display																	○	○	○	○	○
	NWU-350[*3]	19″ Grayscale Display																	○	○	○	○	○
NWB-251 Color Bitmap Interface Board	**NWP-513/NWU-C1601**[*1]	17″ Color Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWP-516/NWU-C1950[*2]	20″ Color Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWU-350[*3]	19″ Grayscale Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
NWB-252 Color Bitmap Interface Board	**NWP-515**	14″ Color Display				○	○	○	○	○													
	NWP-519	17″ Color Display				○	○	○	○	○													
NWB-253[*11] Monochrome Bitmap Interface Board	**NWP-512D**	15″ Monochrome Display				○	○	○	○	○													
	NWP-518	17″ Monochrome Display				○	○	○	○	○													
	NWE-501[*6]	19″ Monochrome Display				○	○	○	○	○													
NWB-254/254P Videomap Display Interface Board	**NWP-515**	14″ Color Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWP-519	17″ Color Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWU-C1605[*7]	16″ Color Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
NWB-255	**NWP-514**	19″ Grayscale Display				○	○	○	○	○													
NWB-512[*11] Monochrome Bitmap Interface Board	**NWP-512D**	15″ Monochrome Display																	○	○	○	○	○
NWB-514 Grayscale Bitmap Interface Board	**NWP-514**	19″ Grayscale Display				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
NWB-518[*11] Monochrome Bitmap Interface Board	**NWP-518**	17″ Monochrome Display									○	○	○	○				○	○				○
	NWP-512D/NWU-M19[*5]	15″ Monochrome Display									○	○	○	○				○	○				○
NWB-232A GPIB	**NWP-5001**	VECTRON									○	○	○	○	○	○	○	○	○	○	○	○	○
Unnecessary	**NWP-511F**[*8]	Kanji Terminal	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWP-517	X-terminal	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWP-512D[*9]	15″ Monochrome Display																					
	NWP-515[*9]	14″ Color Display																					
	NWE-501[*6]	19″ Monochrome Display																					
	NWP-518	17″ Monochrome Display																					
	NWP-519	17″ Color Display																					
	NWP-513[*10]	17″ Color Display																					
	NWP-516[*10]	20″ Color Display																					
	NWU-350[*3]	19″ Grayscale Display																					

Note:
The display size indicates the physical dimensions of the CRT.
To get the visual size, substract one inch from the physical size.

- [*1] • NWU-C1601 is available only in USA, and supported by SMSC.
- [*2] • NWU-C1950 is available only in USA, and supported by SMSC.
- [*3] • NWU-350 is only supported in USA and European market by SMSC, SMSE.
- [*4] • Using NWB-280 with NWB-225A results in the same function as NWB-251.
  However, the NWB-280 cannot be used with the NWS-1510/1410 because that model only has one expansion slot.
- [*5] • NWU-M19 is available only in USA, and supported by SMSC.
- [*6] • NWE-501 is available only in Europe and supported by SMSE.
- [*7] • NWU-C1605 is available only in USA, and supported by SMSC.
- [*8] • Can be used as on RS-232C Interface and ASCII terminal.
- [*9] • Board internally equipped in the main unit.
- [*10] • Board internally equipped in NWS-721.
- [*11] • NWB-253, 512, 518 can be used only with displays of the same destination.

Table 1.9-2
NEWS Products-Interrelationship Table-③-1

Mark ○ indicates the possibility of connection.
Note that some boards may not be directly plugged in the main unit's expansion slot.

			• MPU Board	MPU-4	MPU-6		MPU-2			MPU-3		Modified MPU-3		MPU-7								MPU-8				MPU-5					MPU-13	
			• NEWS Series	700 Series			800 Series					900 Series		1400 Series			1500 Series						1600 Series	1700 Series			1800 Series			1900 Series		1200 Series	
			• Model Name	NWS-711 (UC, J)	NWS-712 (EK)	NWS-721 (UC,EK,J)	NWS-811 (J)	NWS-891 (J)	NWS-821 (J)	NWS-831 (J)	NWS-841 (UC,J)	NWS-911 (J)	NWS-921 (J)	NWS-1410 (J)	NWS-1450 (J)	NWS-1460 (J)	NWS-1510 (EK)	NWS-1520 (EK)	NWS-1530 (EK)	NWS-1580 (EK)	PWS-1520 (J)	PWS-1550 (J)	PWS-1560 (J)	PWS-1630 (J)	NWS-1710 (UC)	NWS-1720 (UC,EK,J)	NWS-1750 (UC,EK,J)	NWS-1830 (UC,EK,J)	NWS-1850 (UC,EK,J)	NWS-1860 (J)	NWS-1930 (UC,EK)	NWS-1960 (J)	NWS-1230 (J)	NWS-1250 (EK,J)
Image Board	**NWB-240A** L.B.P./ Image Reader Interface	**NWP-533/NWE-101*1** A4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-534/NWE-105*1 Image Reader (300dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	NWB-241A L.B.P./ Image Reader Interface	**NWP-537** B4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-534/NWE-105*1 Image Reader (300dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	NWB-242 Image Board	**NWP-533/NWE-101*1** A4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-540*2 Image Reader (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	NWB-243 Image Board	**NWP-543** A3 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-544*3 Image Reader (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-537 B4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-540*4 Image Reader (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Color Image Reader		**NWP-548*5** (300dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Color Printer		**NWP-549/NWE-111*1** (300dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
I/O Interface	**NWB-231A*6** 4 channel Serial Interface Board					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	NWB-232A*7 GP-IB Interface Board					○	○	○	○	○	○	○	○												○	○	○	○	○	○	○		
	NWB-235A*8 Expansion Network Board					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	NWB-260 Audio Interface Board													○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
	NWB-238*9 Modem Board																															○	○
Keyboard		**NWP-410** Thumb Shift Keyboard (Mouse)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
		NWP-411/411A*10 Keyboard (Mouse)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Floor Stand		**NWP-412** Floor Stand				○	○	○	○	○													○	○	○	○	○	○	○				
External Storage Device		**NWP-531*11** Streaming Tape Unit (60MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-536/536A*11 Streaming Tape Unit (125MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-546*11 Streaming Tape Unit (150MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-532*11 Expansion Hard Disk (156MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-535/535A*11 Expansion Hard Disk (286MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-545*11 Expansion Hard Disk (640MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-547*11 Expansion Hard Disk (240MB)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-539N*11 MO Disk Unit (Vertical)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-559*11 MO Disk Unit (Horizontal)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-541*11 CD-ROM Drive Unit				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-542*11 DAT Data Storage Unit (1.3GB)												○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

★-See the NOTE on the next page.

Table 1.9-2
NEWS Products-Interrelationship Table-③-2

Mark ○ indicates the possibility of connection.
Note that some boards may not be directly plugged in the main unit's expansion slot.

			• MPU Board	MPU-16			MPU-12					MPU-15							MPU-10				
			• NEWS Series	3200 Series			3400 Series					3700 Series							3800 Series				
			• Model Name	NWS-3250 (Type D)	NWS-3250 (Type F)	NWS-3260	NWS-3410	NWS-3410 (Type A)	NWS-3410 (Type D)	NWS-3410 (Type E)	NWS-3460	NWS-3710 (Type A)	NWS-3710 (Type D)	NWS-3710 (Type F)	NWS-3720	NWS-3720 (Type A)	NWS-3720 (Type G)	NWS-3720 (Type I)	NWS-3840	NWS-3860	NWS-3865 (Type E)	NWS-3865 (Type G)	NWS-3870
				(UC)	(UC)	(J/EK)	(J)	(EK)	(EK)	(EK)	(J)	(UC)	(UC)	(UC)	(J)	(EK)	(EK)	(EK)	(J)	(J/EK)	(EK)	(EK)	(J)
Image Board	**NWB-240A** L.B.P./ Image Reader Interface	**NWP-533/NWE-101**[*1] A4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-534/NWE-105[*1] Image Reader (300dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-241A L.B.P./ Image Reader Interface	**NWP-537** B4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-534/NWE-105[*1] Image Reader (300dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-242 Image Board	**NWP-533/NWE-101**[*1] A4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-540[*2] Image Reader (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-243 Image Board	**NWP-543** A3 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-544[*3] Image Reader (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-537 B4 L.B.P. (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-540[*4] Image Reader (400dpi)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Color Image Reader		**NWP-548**[*5] (300dpi)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Color Printer		**NWP-549/NWE-111**[*1] (300dpi)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
I/O Interface	**NWB-231A**[*6] 4 channel Serial Interface Board					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-232A[*7] GP-IB Interface Board										○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-235A[*8] Expansion Network Board					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-260 Audio Interface Board					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	NWB-238[*9] Modem Board		○	○	○																		
Keyboard		**NWP-410** Thumb Shift Keyboard (Mouse)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-411/411A Keyboard (Mouse)				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Floor Stand		**NWP-412** Floor Stand										○	○	○	○	○	○	○	○	○	○	○	○
External Storage Device		**NWP-531**[*11] Streaming Tape Unit (60MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-536/536A[*11] Streaming Tape Unit (125MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-546[*11] Streaming Tape Unit (150MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-532[*11] Expansion Hard Disk (156MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-535/535A[*11] Expansion Hard Disk (286MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-545[*11] Expansion Hard Disk (640MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-547[*11] Expansion Hard Disk (240MB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-539N[*11] MO Disk Unit (Vertical)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-559[*11] MO Disk Unit (Horizontal)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-541[*11] CD-ROM Drive Unit		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		NWP-542[*11] DAT Data Storage Unit (1.3GB)		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note:

[*1] • NWE-101, NWE-105, NWE-111 are available only in Europe.

[*2] • NWA-031 Document Feeder (Optional).
• RS-224A is selectable.

[*3] • NWA-036 Document Feeder (Optional).

[*4] • NWA-031 Document Feeder (Optional).

[*5] • For NWS-1200/3200 Series, PCZ-310T SCSI cable is required.

[*6] • Max. 2 card mountable, giving max. 8 channel addition.
• RS-232C or RS-422A is selectable.

[*7] • GP-IB × 1, RS-232C × 2, RS-422A × 1 addition.

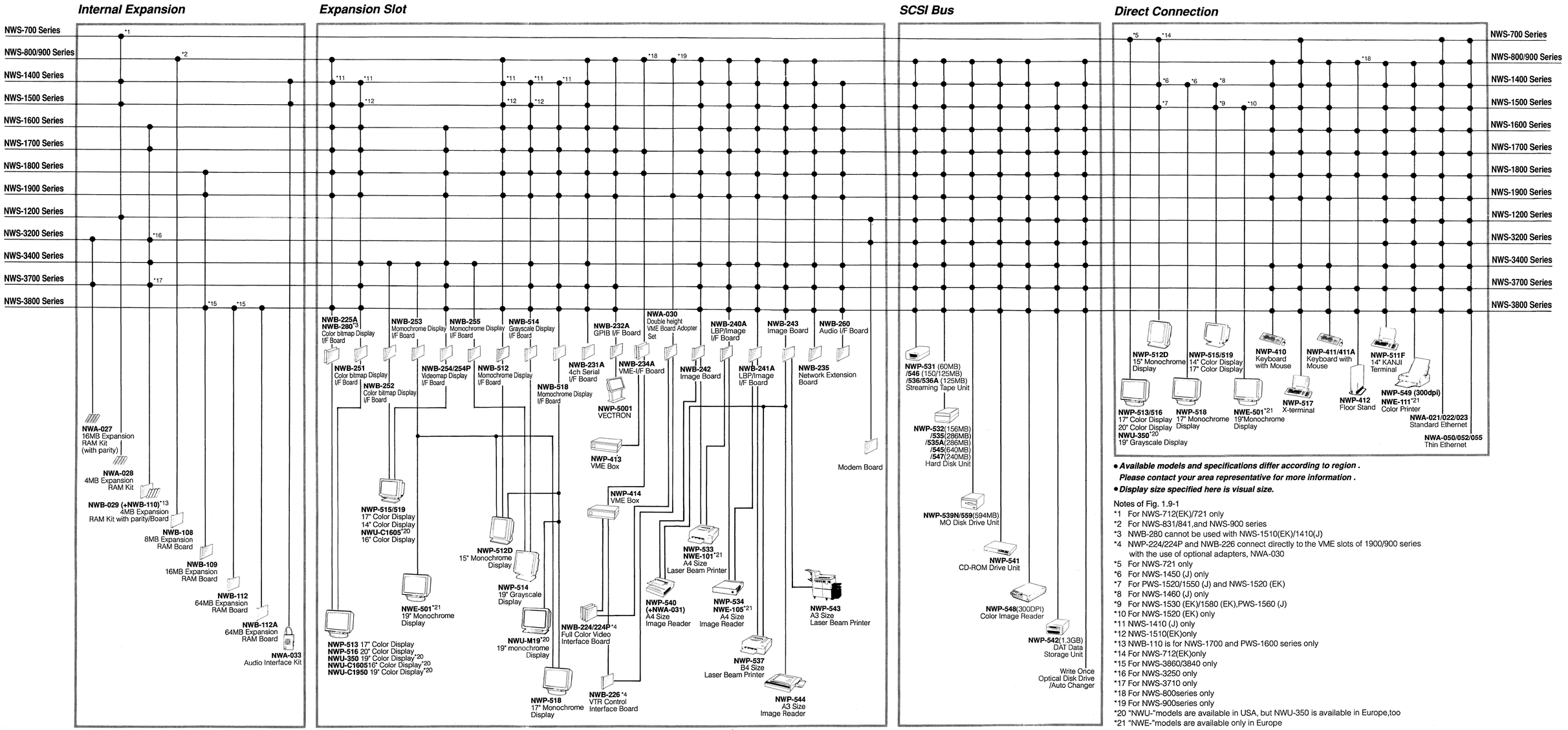
[*8] • External board to give 1 additional channel max. 2 boards to a main unit.
• NWA-021, NWA-022, and NWA-023 are provided as supplied accessories.

[*9] • NWB-238 is designed based on the Japanese telecommunication standard.

[*10] • NWP-411A is supplied standard in NEWS 700 series.

[*11] • Connection between the NWS-1200/3200 Series and the first storage devices must be made via the PCZ-310T SCSI cable.

Figure 1.9-1
NEWS Products-Interrelationship



- ***Available models and specifications differ according to region . Please contact your area representative for more information .***
- ***Display size specified here is visual size.***

Notes of Fig. 1.9-1

*1 For NWS-712(EK)/721 only
*2 For NWS-831/841,and NWS-900 series
*3 NWB-280 cannot be used with NWS-1510(EK)/1410(J)
*4 NWP-224/224P and NWB-226 connect directly to the VME slots of 1900/900 series with the use of optional adapters, NWA-030
*5 For NWS-721 only
*6 For NWS-1450 (J) only
*7 For PWS-1520/1550 (J) and NWS-1520 (EK)
*8 For NWS-1460 (J) only
*9 For NWS-1530 (EK)/1580 (EK),PWS-1560 (J)
*10 For NWS-1520 (EK) only
*11 NWS-1410 (J) only
*12 NWS-1510(EK)only
*13 NWB-110 is for NWS-1700 and PWS-1600 series only
*14 For NWS-712(EK)only
*15 For NWS-3860/3840 only
*16 For NWS-3250 only
*17 For NWS-3710 only
*18 For NWS-800series only
*19 For NWS-900series only
*20 "NWU-"models are available in USA, but NWU-350 is available in Europe,too
*21 "NWE-"models are available only in Europe

Chapter

2

Software Issues

This chapter provides an overview of NEWS-OS Release 4.0, (the most recent NEWS-OS release) as of December, 1990. For more detailed information, please refer to the "Release Notes" which are issued to accompany each new release and the "NEWS-OS Manual Set (NWM-660)".

Contents

2.1 Overview of NEWS-OS Release 4.0

The following is an overview of NEWS-OS Release 4.0, (the most recent NEWS-OS release) as of December, 1990.

2.1.1 Overview

There are two series of NEWS hardware: one applies CISC (MC68020/MC68030) to the CPU, and the other applies RISC (R3000) to the CPU.

The OS corresponding to CISC NEWS is called **NEWS-OS Release 4.0C**, and the OS corresponding to RISC NEWS is called **NEWS-OS Release 4.0R**, so we use the generic name **NEWS-OS Release 4.0** in this manual.

NEWS-OS Release 4.0 supports X Window System Version 11 Release 4, OSF/Motif, and NFS 4.0, based on UNIX 4.3 BSD.

The main features of NEWS-OS Release 4.0 are as follows.

- Compatible host with NEWS-OS Release 3.X
- Loads a portion of System V and POSIX functions
- User interface
  - X Window System Version 11 Release 4
  - OSF/Motif Version 1.1
  - NEWS Desk
  - Kana/Kanji Conversion Front End sj3
- Multiple language correspondence
  - Japanese, 10 western European languages, Korean, Chinese (TCA)
- Network support
  - Loads SNMP, the network management tool.
  - Applies 4.3 BSD tahoe version network codes
  - Corresponds with BIND name server
- File system support
  - NFS 4.0
  - CDFS
  - PCFS
  - FFFS
  - Dynamic buffer support
- Multiple media correspondence

2.1.2 Diskless Workstation Support

NEWS-OS Release 4.0C and Release 4.0R allow the following server-client combinations.

Server \ Client	RISC workstation	CISC workstation
RISC machine	○	○
CISC machine	×*1	○

*1: Due to licensing difficulties, NEWS-OS does not support CISC servers for RISC clients.
Note: NEWS-OS version for a CISC workstation must be the same as that for a RISC workstation.

2.1.3 Distribution Media

NEWS-OS Release 4.0 is distributed on the following media.

1) Streaming Tape (QIC-24 format) × 4

   3.5″ Floppy Disk × 2

   (One is used for formatting the hard disk, the other is used for the actual installation)

2) Streaming Tape (QIC-120 format) × 2

   3.5″ Floppy Disk × 2

   (One is used for formatting the hard disk, the other is used for the actual installation)

3) MO Disk × 1

   3.5″ Floppy Disk × 2

   (One is used for formatting the hard disk, the other is used for the actual installation)

Note: NEWS-OS Release 4.0 can be installed from a server workstation via network. The network installation can be performed only one client workstation at a time.

2.1.4 Models and Peripherals to Be Supported

The expansion boards and peripherals supported by NEWS-OS Release 4.0 is same as Table 1.9-1.

2.2 Features of the NEWS-OS Kernel

The NEWS-OS kernels for different hardware models are described below.

- **NEWS-OS Release 4.0C**

1) NWS-7xx Series:

Kernel for diskless workstations (/vmunix)

2) NWS-8xx, 9xx Series:

Main CPU version for dual CPU workstations (/vmunix)

IOP version for dual CPU workstations (/iopboot)

3) NWS-12xx Series:

Kernel for laptop workstations (/vmunix)

4) NWS-14xx, NWS-15xx, NWS-17xx, PWS-15xx Series and PWS-1630:

Kernel for single CPU workstations (/vmunix)

5) NWS-18xx, 19xx Series:

Main CPU version for dual CPU workstations (/vmunix)

IOP version for dual CPU workstations (/mrx)

- **NEWS-OS Release 4.0R**

1) NWS-34xx, 37xx, 32xx Series:

Kernel for single CPU workstations (/vmunix)

2) NWS-38xx Series:

Main CPU version for dual CPU workstations (/vmunix)

IOP version for dual CPU workstations (/mrx)

The NEWS-OS kernel is available in the above versions. All are specially implemented for the NEWS Series and based on the UNIX 4.3BSD Kernel. Also, device drivers to support peripheral devices are provided as standard, allowing user programs to access these devices easily using system calls. See the "NEWS-OS Release 4.0 Manual Set (NWM-660)" for details. In particular, in dual CPU workstations a single chip is used as both the I/O processor and the main CPU, so processing speed is nearly unaffected even if the burden imposed by communications, color bitmap displays or disk access becomes considerable. This is because the I/O processor is provided with a large amount of SRAM locally. When running a multitask monitor (*/iopboot* or */mrx*), any necessary high speed processing can be executed by the I/O processor portion without imposing any additional burden on the main CPU portion.

2.3 NEWS-OS Standard Software

The NEWS-OS standard software is described below. (quoted)

• X Window System

X Window System was developed as part of the Distributed Educational Environment Architecture Project Athena at MIT. X Window is a server/client type windowing system under which application programs run as client processes. Server processes include bitmap display output management, window management and management of mouse and keyboard input. Client processes issue requests to the server and receive the requested service from the server. Requests take the form of communications between processes. Multiple client processes can exist on the system at any one time, and, as long as communications links are provided, may be located on any machine in the network. User programs do not communicate directly with server processes. Instead, they must obtain server services using a C library called Xlib. See the on line documents */usr/man/C* or the NEWS-OS Manual for details.

The latest versions of the X Window System, Version 11 Release 4 is bundled with NEWS-OS Release 4.0.

• NFS

NFS is a distributed filing system developed by Sun Microsystems Inc. It allows the distributed resources of a network to be combined into a single logical area. It is employed by a large number of computer manufacturers and users all over the world, and has become the industry standard open distributed processing environment software.

The Version 4.0 of NFS comes bundled with NEWS-OS Release 4.0. See "Chapter 3: Network Issues and the NEWS-OS Software Manual" for details.

• System V IPC

NEWS-OS Release 4.0 loads System V IPC (Inter Process Communication).

- Messages
- Semaphores
- Shared memory

Messages are used to send or receive data through the system buffer between optional processes.

Semaphores are used for synchronous/exclusive control between processes.

Shared memory materializes sharing of virtual space by more than one process.

Refer to the section "System V IPC" in the Programmer's Guide of NWM-660 NEWS-OS Release 4.0 Manual Set.

• **OSF/Motif**

NEWS-OS Release 4.0 supports OSF/Motif Release 1.1. OSF/Motif is a user environment created in X Window System, and is composed of the following.

- Motif Widgets
- Window manager (mwm)
- User interface language (Uil)

NEWS-OS Release 4.0 has added Japanese correspondence changes to these functions.

Refer to the following On-Line Manuals or manuals on sale for details about OSF/Motif.

- On-Line Manual. *mwm* (1), *Xm* * (3XM), *uil* (1)
- NWM-655A NEWS-OS OSF/Motif R1.1 Manual set

• **NEWS Desk**

Sony has installed its own desktop environment (NEWS Desk) in NEWS-OS Release 4.0.

NEWS Desk is a user-friendly environment which enables anyone to use NEWS applications. Rather than complicated NEWS-OS commands, a mouse is used to select items from the screen to boot up application programs, run electronic mail, manage the system, etc.

Refer to the "NEWS Desk User's Guide" of the NWM-660 NEWS-OS Release 4.0 Manual Set for details on NEWS Desk.

• **SNMP (Simple network management protocol)**

NEWS-OS Release 4.0 supports network management protocol SNMP (Simple Network Management Protocol).

SNMP has been developed and standardized as a network management protocol based on TCP/IP. This is presently the network management protocol most widely used in the multi-vendor environment.

SNMP is implemented on top of UDP (User Datagram Protocol). Objects which network entities to be managed (such as gateways, hosts, routers, etc.) now have with this addition and the basic client data structures for these are included as part of the specification. Objects are a collection of variables known as MIB (Management Information Base).

For details on SNMP, refer to the section

- "Network Management" in the "Administrator's Guide" of the NWM-660 NEWS-OS Release 4.0 Manual Set.

Refer also to the On-Line document provided in the following directory.

- /usr/sony/doc/SNMP

2.4 Installing the NEWS-OS

2.4.1 Installation Techniques

There are two types of installation techniques available for NEWS-OS Release 4.0.

1) Full Installation

A full installation should be used when you wish to install a completely new NEWS-OS from scratch.

A variety of programs can be selected for installation from an on-screen display at this time.

2) Additional Installation

Additional installation should be used when you wish to add new programs (such as the fortran compiler) after having already installed NEWS-OS Release 4.0 with method 1 described above.

Also, it is possible to change partition size with the installation of NEWS-OS Release 4.0. Be sure to specify partition size in accordance with the requirements of your own working environment.

See the "Installation Manual" for further details.

2.4.2 Target of Installation

The target of installation can be determined by selecting from the menu and setting the SCSI Channel No.

	Workstations with Built-In Hard Disk	Diskless Workstations	Comment
NEWS-OS 4.0	Full installation possible on an expansion hard disk (SCSI channel 1), besides the internal hard disk.	Full installation possible by connecting a Sony external hard drive. Hard disk must be formatted for 256MB or more.	It is possible to install for PWS-15XX and PWS-1630 on the internal hard disk normally.

2.5 Concerning NEWS-OS Release

There are three ways in which we name new NEWS-OS releases. The change made in the name corresponds to the type of change made in NEWS-OS.

2.5.1 Change in the digit to the left of the decimal point (Ex. Rel 3.0 vs. Rel 4.0)

This indicates basic changes in overall concept or design. In general, the new version is not full compatible with older versions. For example, this type of name change would be made if NEWS-OS, currently based on UCB 4.2BSD, were to be based on UCB 4.3BSD and full compatibility could not be guaranteed.

2.5.2 Change in the digit to the right of the decimal point (Ex. Rel 4.0 vs. Rel 4.1)

This indicates minor changes or the addition of new features. In general, the new version is compatible with older versions. Examples include cases in which a new driver is made available for use with a newly marketed peripheral device.

2.5.3 Additional suffix number (Ex. Rel 4.0.1 vs. 4.0.2)

This indicates bug fixes of the corresponding release, usually provided with floppy disks.

Documentation concerning new versions, called "Release Notes," will be provided with each new release to explain the reasoning behind and major points concerning the new version of NEWS-OS. It is therefore possible to understand the new version of NEWS-OS through the combined use of the "NEWS-OS Manual Set" and "Release Notes."

2.5.4 Issuance of NEWS-OS Related Documentation

The types of documentation issued with the release of new versions of NEWS-OS, as described in 2.5.1 through 2.5.3 above, are as follows.

NEWS-OS Release	case of 2.5.1	case of 2.5.2	case of 2.5.3
Release Notes	○	○	○
NEWS-OS Manual Set	○	△	×
NEWS-OS Reference Manaul	○*	×	×

○ : issued/revised
△ : Issued for only new chapters.
× : not issued
○* : English version issued/revised if possible. (English version only)

Chapter

3

Network Issues

This chapter describes the details of the network. Preparations required to use the network are also contained in this chapter. Some of the contents which should be discussed in "NEWS-OS Software Manual" are included for your convenience.

It is necessary to refer to the "NEWS-OS Software Manual" in order to get an overall understanding of the NEWS-OS.

Each of the system setting and the diskless machine setting is described in a separate part. This chapter is intended to help you understand the diskless setting.

I. System Setting

II. Setting up a Diskless Workstation

I

System Setting

TABLE OF CONTENTS

3.1 Adding User

To catalog a user, the following steps are required:

1. Adding User to /etc/passwd
2. Specifying User Group
3. Creating User's Home Directory
4. Creating User's Password

3.1.1 Adding User to */etc/passwd*

To add a user, you should edit */etc/passwd* file and enter a user's entry using the **vipw** command as a super user.
The command copies */etc/passwd* file to */etc/ptmp* file first.
The editing is performed on the */etc/ptmp*.
At the end of the editing */etc/ptmp* is moved to */etc/passwd*. The */etc/ptmp* file is used for security and to lock the */etc/passwd* file to prevent concurrent access from many processes. The format of the */etc/passwd* file is:

user_name: password:user_id:group_id:comment:home_directory:shell

user_name To maximum eight alphanumeric characters. The first character must be an alphabetic or symbolic character. It is recommended to avoid using uppercase characters for all eight characters.

password Leave it blank. In other words, place two colons (:) without a space. An encoded password is set later by the **passwd** command.

user_id A unique user identifier expressed with numbers. Normally two or more digits such as "101" is used. As the number of users increases, increment it as "102", "103", and so on.

group_id A group identifier to which users belog. Users in a same group have same group id. Use two or more digits for this also. Specify the number (the third item of the line) specified in the */etc/group* file.

comment User's information such as name, telephone number, and personal information is written. You may insert space; however, "(" and ")" may not be handled correctly when you use mail function. To display your comment, use the **finger** or **f** command. To modify a comment, you may edit it using the **chfn** command.

home_directory Specify the path name of user's home directory. Normally, user's home directory locates under */var/home*.

shell The path name of program activated at login. You can login only with the shell defined in the file */etc/shells*. Normally, specify */bin/sh* or */bin/csh*.

An example of */etc/passwd* file:

```
guest::9999:31:& user:/var/home/guest:/bin/csh
john::31900:19:John Smith,444-4444:/var/home/john:/bin/csh
```

To confirm the above using the **finger** of f command:

Example:

```
% f
Login   Name          TTY Idle    When        Office
john    John Smith    co 3:30     Wed 08:17   444-4444
john    John Smith    p0:3:29     Wed 13:27   444-4444
john    John Smith    pl          Wed 13:27   444-4444
```

To modify the default user shell previously established, you may modify your own shell using the **chsh** command if "Network Information Service" is not used. When the **chsh** command is used, you cannot set the shell to be used other than ones written the */etc/shells* file. For more information about the **vipw** command, see *vipw* (8) in On-Line Manual. For more information about the */etc/passwd* file, see *passwd* (5) in On-Line Manual.

3.1.2 Specifying User Group

Each user may belong up to ten groups at the same time. Specify user group, in the */etc/group* file.
To modify the */etc/group* file, you may use a general editor such as **vi**.
The format of the */etc/group* file is:

```
group_name:*:group_id:user_list
```

group_name	Group name consisting of alphanumeric characters.
group_id	Group identifier expressed as a number.
user_list	List of user names who belong to that group. Separate each user name with comma (,).

An example of */etc/group* file:

```
wheel:*:0:root
daemon:*:1:daemon
kmem:*:2:root
sys:*:3:root
tty:*:4:root
operator:*:5:operator
news:*:6:news
staff:*:10:root
guest:*:31:guest
ingres:*:74:ingres
```

where, "wheel" is the super user group. Only the users specified as "wheel" become super users. For example, to enroll *user1* and *user2* as super users, specify as follows:

```
wheel:*:0:root, user1, user2
```

For more information about the */etc/group* file, see *group* (5) in On-Line Maunal.

3.1.3 Creating User's Home Directory

Create a home directory of the user specified in the */etc/group* file. Either create *.cshrc* and *.login* files of your own, or copy the template files from */usr/sony/skel* and just change the user id and group id according to the user.
The *.cshrc* file is executed at activation while the *.login* file is executed at login. These are csh script files and are used to set command search path and prompt.

3.1.4 Creating User's Password

As a super user, you may create your own password by entering:

```
% passwd user_name
```

If user environment has already been established and you have entered the system with your user name, you do not have to enter the user name to modify the password. If a password has already been set, the system prompts as follows:

```
Old password:
```

Enter the previously set password. The system prompts as follows:

New password:

Enter a new password with up to eight alphanumeric characters. In response, the system prompts as follows:

Retype new password:

Enter the new password again for confirmation. After the above steps, the password is encoded and cataloged as the user's password in the */etc/passwd* file. To confirm the user's personal information written in the */etc/passwd* file, use the **finger** or **f** command. The **finger** or **f** command will also display the contents of *.plan* and *.project* files created by the user under the user's home directory.

3.2 Terminal Control

To connect a terminal (such as a personal computer) to the rear of the machine or to RS-232C serial interface (separately sold), you must follow the procedure shown below to write the information required to login:

3.2.1 File /etc/ttys

The */etc/ttys* file contains login authorization information for the terminal. For NEWS-OS Release 4.0, the format of the */etc/ttys* file is:

Line_name	Valid_command	Terminal_type	Login_status	Priviledge_status	Comment
tty00	"/etc/getty std.9600"	unknown	off	secure	

For example: to connect "vt100", change this to:

tty00	"/etc/getty std.9600"	vt100	on	secure

where, the first field is obtained by omitting the "/dev/" from the device name. For NEWS-OS System, tty00 and tty01 are packaged as RS-232C line.
The second field is the command which is executed on the line. If login from terminal is allowed, the **init** command is specified as a valid command and the arguments such as baud rate are specified in the */etc/getty*.
The third field specifies type of the terminal to be connected to the line. This should be the same type as the one described in */etc/termcap*.
The fourth field specifies either "on" or "off". If it is on, the **init** command will execute */etc/getty* specified by the second field. If it is off, the **init** command will not execute.
If "secure" is specified in the remaining field, user who has "0"-numbered user id (root) is allowed to login to the line. If "secure" is not specified, the user is not allowed to login in root.
If a quoted command follows "window=" in the comment line, the quoted command will be executed before the command specified in the second field.

An example of */etc/tty/* file:

```
console   "/etc/getty std.9600"   news      on secure
tty00     "/etc/getty std.9600"   vt100     off secure
tty01     "/etc/getty std.9600"   vt100     on secure
                .
                .
ttyp0     none                    network   off secure
ttyp1     none                    network
                .
                .
ttyv0     "/usr/bin/X11/xterm -C -L -fn vtsingle -fb vtbold -display :0"
          xterm on secure window="/usr/bin/X11/Xnews"
```

If a printer is connected to the serial interface, the login status should be disabled.
For any system with bitmap display, "channel 0" and "channel 1" of RS-232C are tty00 and tty01, respectively.
On the other hand, for any system without bitmap display, "channel 0" and "channel 1" of RS-232C are console and tty01, respectively. Therefore, for any system without bitmap display, tty00 should be set as login disabled in the file */etc/ttys*.
After setting the */etc/ttys*, perform **kill -HUP 1**.

[Notes]
If you add or delete any entry to/from */etc/ttys* fule during the system operation in multi-user mode, do not forget to perform the command **kill -HUP 1**.

3.2.2 File /etc/termcap

The */etc/termcap* file is a database containing information such as escape sequences of each terminal.
It contains information about three hundred or more terminal types.
If you connect a new terminal, you must add an entry to the */etc/termcap* file based on the specifications of the terminal.

/etc/termcap entry
NEWS-OS Release 4.0 termcap entries to be used in **xterm** and console have changed from what they used to be. The termcap entry in the console has changed from *news*, *newscbm* to the following format:

news-(line_number)-(terminal_code)

However, if the terminal code is *ascii*, the format changes to:

news-(line_number)

Correspondence between Bitmap Displays used for the console and termcap entries is shown in the table below. However, NEWS-OS Release 3.X entry names can be also used for compatibility.

Display	Terminal code		
	sjis	euc	ascii
NWP-512D, NWP-514	news-42-sjis	news-42-euc	news-42
NWP-513, NWP-515, NWP-516 NWP-518, NWP-519	news-33-sjis	news-33-euc	news-33
NWS-1200,NWS-3200	news-29-sjis	news-29-euc	news-29

Since the format of the console termcap entries are not the same in NEWS-OS Release 3.X and 4.0 displays are sometimes incorrect when accessing the terminal in NEWS-OS Release 4.0 from one in NEWS-OS Release 3.X using **rlogin** or **telnet**. This can be avoided by referencing */usr/etc/termcap* file of NEWS-OS Release 4.0 and customizing NEWS-OS Release 3.X termcap file.
Termcap file is stored in the directory */public/etc* in NEWS-OS Release 3.4 and earlier, and in the directory */usr/etc* in NEWS-OS Release 3.9/3.91R.

Note these differences when customizing. To avoid any troubles, first start up **sj2** in the terminal of NEWS-OS Release 4.0, then execute remote login to the terminal of NEWS-OS Release 3.X.

The entry format for the termcap to be used for **xterm** is:

xterm-(*terminal_code*)

Correspondence between terminals and termcap entries are shown in the following table.

Terminal code	termcap entry
ascii	xterm
sjis	xterm-sjis
euc	xterm-euc
tca	xterm-tca

3.3 Printer

To connect printer such as line printer and laser printer with Centronics interface, our video interface and RS-232C interface, following steps are required.

1. Change the */etc/printcap* file
2. Create directory and file associated with the */etc/printcap* file and execute **chown** (change owner)
3. In the case of the remote printer, add client's host name into the */etc/hosts.equiv* or */etc/hosts.lpr* file of printer server host workstation

There are four printer catalog examples as follows:

1. Example of default printer with Centronics interface (local printer)
2. Example of laser printer with our video interface (local printer)
3. Example of laser printer with RS-232C interface (local printer)
4. Example of remote printer

3.3.1. Example of Default Printer with Centronics Interface (Local Printer)

If you want to print out, you should use **lpr** command. **lpr** command has a default printer name called "lp". Following is an example of the "lp" entry in */etc/printcap* file. This example is for the line printer.

```
lp | local line printer:\
    :ct=ja_JP.SJIS:\
    :lp=/dev/lp0:sh:\
    :sd=/usr/spool/lpd:\
    :lf=/usr/adm/lpd-errs:\
    :cf=/usr/sony/lib/lpf_clsif:
```

Each entry means:

lp Printer name. This is a default printer name of lpr.

ct Code type of the printer. The value of **ct** entry is one of the followings:

Code conversion		
Language environment	**ct** of printer	Conversion
ja_JP.SJIS or C	ja_JP.EUC	To Japanese EUC code
XXX	news or C	To 7-bit code conforming the ISO 2022
XXX	Undesignated	Non-conversion
XXX	Same as the left	Non-conversion
XXX	Different from the left	To 7-bit code conforming the ISO 2022

XXX means "C", "ja-JP.SJIS","ja_JP.EUC", "Ko_KR.EUC", "zh_TW.TCA", or "en_US.88597".

This automatic code conversion is controlled by using option –U.

lp Device name which is open for output.

sd Spool directory. /dev/lp0 is a centronics interface device.

lf Error logging file name.

cf Name of filter for CDIF data.

3.3.2. Example of Laser Printer with Our Video Interface (Local Printer)

```
smlbp | nwp533 | nwp-533 | NWP533 | NWP-533 | Sony NEWS NWP-533:\
    :ct=ja_JP.SJIS:\
    :lp=/dev/lbp:sh:\
    :mx#0:lb:li=/usr/sony/lib/lbpinfo:\
    :lf=/usr/adm/nwp533-errs:\
    :sd=/usr/spool/nwp533:\
    :nf=/usr/sony/lib/lpf_lbpnf:\
    :tf=/usr/sony/lib/lpf_lbpnf:\
    :xf=/usr/sony/lib/lpf_xwdlbp:\
    :ef=/usr/sony/lib/lpf_lbp8em:\
    :if=/usr/sony/lib/lpf_sjlbp:\
    :cf=/usr/sony/lib/lpf_lbpif:
```

Each entry means:

smlbp Printer name

ct Code type of the printer

lp Device name

mx Maximum file size (in BUFSIZ blocks), zero = unlimited

lb Indicates this printer is LBP (NWP-533/537/543). The extended mechanism to report the error is used

lf Error logging file name

sd Spool directory

nf Ditroff data filter (device independent troff)

tf Troff data filter (cat phototypesetter)

xf Name of filter for xwd image date

ef LBP-8 Emulator

if Name of default text filter

cf Name of filter for cdif data

3.3.3 Example of Laser Printer with RS-232C Interface (Local Printer)

```
lbp | RS-232C laser printer, col=116 line=66:\
    :lp=/dev/tty01:sh:\
    :br#9600:\
    :pl#66:\
    :pw#116:\
    :sd=/usr/spool/lbp:\
    :lf=/usr/adm/lbp-errs:\
    :nf=/usr/sony/lib/lpf_lbpnf:\
    :tf=/usr/sony/lib/lpf_lbpnf:
```

Each entry means:

lbp	Printer name.
/dev/tty01	RS-232C interface, tty driver.
br	Baud rate.
pl	Page length.
pw	Page width.

3.3.4. Example of Remote Printer

```
rlbp | nwp533 | Sony NEWS NWP-533:\
    :lp=:\
    :rm=nws0:\
    :rp=smlbp:\
    :sd=/usr/spool/rlbp:\
    :lf=/usr/adm/rlbp-errs:
```

Each entry means:

rlbp	Printer name.
rm	Remote host name which is a printer server.
rp	Remote printer name of remote host.

Note that you must enter your host name into */etc/hosts.equiv* or */etc/hosts.lpr* file of the remote printer server workstation.

3.3.5.lpr

lpr command has a default printer name "lp".
But you can change default printer name by setting the environment variable PRINTER.

```
% setenv PRINTER printer_name
% lpr file_name
```

You can also specify the printer name by -P option of lpr.

```
% lpr -P printer_name file_name
```

Any other information about lpr, see *lpr* (1) in On-Line Manual.

3.3.6. lpq

When a user requests a printer for a file using the lpr command, the file is copied to the spool area and a job number is given. (This is called a *queue*.)
The file is output via the specified filter in its turn.
The lpq command displays information such as the queue, job number and requested user name.

3.3.7. lprm

You can remove the desired jobs from the printer queue by specifying the job numbers or user name with lprm command.

```
% lpq

    lbp is ready and printing

Rank    Owner   Job     Files       Total Size
1st     guest   184     /tmp/a      2121 bytes
2nd     guest   183     /tmp/b      1698 bytes
3rd     guest   186     /tmp/c      1824 bytes

% lprm 184          (Removing the printing job numbered 184.)

% lprm guest        (Removing the printing jobs of the owner guest from the queue.)
```

3.3.8 lpc

When the printer daemon stops due to some reason or excessive files are spooled, use the **lpc** command to restart the daemon or to delete the spool file.
When you run **lpc** command and input ? command, **lpc** displays the following.

```
lpc> ?
Commands may be abbreviated. Commands are:

abort      disable    restart    topq
clean      down       start      up
enable     help       status     ?
exit       quit       stop
```

Each commands means:

abort	Halts the printer daemon.
clean	Deletes the printer queue.
disable	Disables a printer's spooling queue.
enable	Allows a printer's spooling queue.
restart	Activate a new printer daemon to reuse the printer output.
start	Resumes the printer output.
status	Displays the printer status. If you omit the printer name, it displays the information about all printers specified in the file */etc/printcap*.
stop	Stops the printer output.
topq	Places the specified job to the top of the printer queue.

For more information, see ***lpc*** (5) in On-Line Manual.

3.4 File Management

You may not know when the file system is exhausted because there is no restriction of available file capacity in the UNIX system.

3.4.1 To Obtain Total Disk Volume of the System

The amount of free disk space, volume of disk itself, and disk space currently used are reported if you execute the **df** command as follows. You may not be able to create a new file even when there is enough space in the disk due to lack of number of i-nodes. This happens in a case when you made many small files because only certain number of i-nodes is prepared for each partition.
Therefore, user must check the file space regularly.

Example:

df	Displays total free space of all disks, volume of disk itself, and disk space currently used.
df –i	Displays total volume of i-nodes of all disks.

3.4.2 To Obtain Directory Capacity

The amount of current directory space is reported if you execute the **du** command as follows:

Example:

du – s	Displays the total capacity under the current directory.
du	Displays the capacity of each directory.
du – a	Displays the capacity of each file as well as directory.
du *directory*	Displays the capacity of specified directory.
du – a *directory*	Displays the capacity of each file under the specified directory including the directory.

3.4.3 File System Verification

fsck verifies the file system. If necessary, it also restores the file system. For NEWS-OS system, verification and restoration will be performed at every system activation by **fsck**.
To verify only, use **fsck** –n.

3.5 Backup

It is recommended to backup the files regularly to cope with operational error and system clash.

3.5.1 Formatting the Floppy Disk

Before a new floppy disk can be used, it must be formatted.

An example for 2HD:

```
myname# format /dev/rfh0a
```

An example for 2DD:

```
myname# format /dev/rfd0a
```

3.5.2 File System Backup

To backup a file system entirely, use the **dump** command.
The **dump** command is normally executed in single user mode. The file system to be dumped should be unmounted beforehand except the root file system.
The **dump** command is able to handle more than one volume. You should replace the media in response to the console message. If you dump the file system into floppy disks, specify the volume size with V option.
The volume size varies as follows according to the media used:

media	device	size (K byte)
2HD	/dev/rfh0a	1440
2DD	/dev/rfd0a	720

An example for streamer:

```
myname # dump 0f /dev/rst00 /dev/rhd0f
```

An example for floppy disk:

```
myname # dump 0vf 1440 /dev/rfh0a /dev/rhd0f
myname # dump 0vf 720 /dev/rfd0a /dev/rhd0f
```

For more information about the **dump** command, see ***dump*** (8) in On-Line Manual.

3.5.3 Restoring the File System Previously Dumped

To restore the file system previously saved by the **dump** command, use the **restore** command. Mount the file system and execute the **restore** command on that directory. To restore the file dumped into several volumes, you should replace the media in response to the console message. Specify the volume size if you restore the file system from floppy disks.

An example for streamer:

```
myname # restore rf  /dev/rst00
```

An example for floppy disk:

```
myname # restore rvf  1440  /dev/rfh0a
myname # restore rvf  720  /dev/rfd0a
```

The **restore** command can be used for a multi volume with streamer, and it cannot be used with floppy disks.
For more information about the **restore** command, see *restore* (8) in On-Line Manual.

3.5.4 tar Command

The **tar** command is used to backup several files together or an entire directory. The file system where the files to be backed up exist should be mounted. During the backup execution, do not modify the files to be backed up.

An example for streamer:

```
myname # tar cvf  /dev/rst00  file1  file2...
```

An example for floppy disk:

```
myname# tar cvf  /dev/rfh0a  file1  file2 ...
myname# tar cvf  /dev/rfd0a  file1  file2 ...
```

The **tar** command is also used to restore the files.

An example for streamer:

```
myname # tar xvf /dev/rst00
```

An example for floppy disk:

```
myname# tar xvf /dev/rfh0a
myname# tar xvf /dev/rfd0a
```

3.5.5 Useful Processing via tar Command

The tar command is not only used to backup to tape or floppy disk but also used as follows:

```
myname# tar cf - file | (cd /usr/tmp; tar xvpf - )
myname# tar cf - file | rsh hostA '(cd /usr/tmp; tar xvBpf - )'
myname# tar cvf - file | compress > file.Z
myname# zcat file.Z | tar xvf -
myname# tar cvf - file | rsh hostA dd of=/dev/rtu00
```

The first line copies the file under */usr/tmp*.

The second line copies the file under */usr/tmp* of remote host A.

The third line compresses file as named *file.Z*.

The forth line restores the file from *file.Z*.

The fifth line backs up the file into a streamer tape of remote host A.

3.6 Network Setting

In the UNIX system, network is started up by executing the **ifconfig** command in */etc/rc.local* after setting up the */etc/hosts*.
To setup the network, follow the steps below:

1. Setting the host name.
2. Setting the Internet Protocol (IP) address.
3. Setting the network name.
4. Setting the domain name.
5. Setting the network command permission.

After all of the above are completed, perform the **fastboot.**

In NEWS-OS Release 4.0, files used for network setting are as follows:

rc	command script for auto-reboot and daemons
rc.custom	script for basic some shell variables and basic customization
rc.local	script holding commands which are pertinent only to a specific site
rc.net	sript holdihg commands which set up the network environment

3.6.1 Setting the Host Name

To identify each NEWS system on the network, a unique host name must be provided. However the length of the host name is 31 or less characters, it is recommended to use only 7 or less characters taking UUCP use into consideration. Note that no uppercase characters are allowed.
Usually, host name is specified in the */etc/rc.custom* file of each workstation automatically when the system is activated. Therefore, modify the */etc/rc.custom* file if you want to specify the host name.
You will find the following line in the */etc/rc.custom* file:

HOSTNAME=*myname.my.domain*

Change *myname. my.domain* field to the host name of your workstation.

Example: **if the host name is "nws0".**

HOSTNAME=*nws0*

For more information, refer to ***hostname*** (1) in On-Line Manual.

3.6.2 Setting the Internet Protocol (IP) Address

After you determined the host name of each workstation, you should specify the IP address of each host name. Each host on the network is not identified by its name. It is actually identified by this IP address. An IP address is expressed as 4-byte (32 bits) integer. IP addresses are divided into the following three classes based on the value of the first byte (bits 24-31):

Value of the 1st byte	Class
0 ~ 127	A
128 ~ 191	B
192 ~ 255	C

[Notes]

The IP address, 127.0.0.1 cannot be used because it is reserved for software loop back/network interface within the kernel. An IP address consists of two parts, a network number and a host number. This structure is defined as follows based on the class:

Class	Address structure
A	NHHH
B	NNHH
C	NNNH

Where:

N is the network number.

H is the host number.

For class A, the first byte alone indicates the network number while remaining three bytes together indicate the host number.

For class B, the first and second bytes together indicate the network number while the third and fourth bytes together indicate the host number.

For class C, the first, second, and third bytes together indicate the network number while the fourth byte indicates the host number.

[Notes]

A host cannot directly communicate with another host with different network number. In such a case, a routing is required. The host number 0 (zero) cannot be used because it is reserved for broadcast.

IP addresses set for each host name are entered in the file */etc/hosts*. The file */etc/hosts* is a database file which associates the address with the host name connected to the network. The first item on each line of */etc/hosts* file is an IP address. It is ideal to specify worldwide unique value to such number string. It is acceptable to provide a unique IP address for each network terminal of all of the connected workstations.

You will find the following lines in */etc/hosts* file:

An example of */etc/hosts* file:

IP address	hostname	alias
127.1	localhost	*localhost.my.domain*
192.43.189.1	*myname.my.domain*	*myname*

The word next to IP address is the corresponding host name. Among these, "localhost" has a special meaning. It is used as local loop back which is necessary to communicate to itself. Note that 127.1 is an abbreviation for 127.0.1 or 127.0.0.1.
For example, if you set workstations, *nws0*, *nws1*, and *nws2*, you would specify as follows:

An example of */etc/hosts* file:

IP address	hostname	alias
192.0.1.10	nws0	serv
192.0.1.11	nws1	clnt1
192.0.1.12	nws2	clnt2

In this example, IP address for host name *nws0* is 192.0.10, IP address for host name *nws1* is 192.0.1.11, and IP address for host name *nws2* is 192.0.1.12. In addition, alias *serv* is specified to host name *nws0*, alias *clnt1* is specified to host name *nws1*, and alias *clnt2* is specified to host name *nws2*.
For more information about the IP, see *inet* (3N) and *hosts* (5) in On-Line Manual.
If you change any contents of */etc/host* file, you must execute **/etc/mkhosts** command.
The **/etc/mkhosts** command is used to create hashed host database. The execution format of the **/etc/mkhosts** command is:

```
% mkhosts /etc/hosts
```

If **/etc/mkhosts** command completes successfully, the number of hosts in hosts file and the maximum length will be displayed.

Example: If the number of hosts is 1054 and the maximum length is 46, the follwing message is displayed:

```
1054 host entries, maximum length 46
```

3.6.3 Setting the Network Name

Ethernet cable, RS-232C cable, or local loop back has a dedicated interface and each is considered to be a network. A name is given to each network and is used to establish a gateway or other.
The */etc/networks* file contains settings of variables related to the networks used in */etc/rc.local*. In this example, it contains descriptions of three networks, "sonyAnet,sonyBnet, and sonyCnet" as shown below.
An example of */etc/networks*:

```
loopback-net        127     software-loopback-net
sonyAnet                    234.0.1
sonyBnet                    234.0.2
sonyCnet                    234.0.3
```

loopback-net on the first line is the software-loopback-net. You must specify 127 for this. The second to fourth lines define the network names. The network address is obtained by substructing the host address from the IP address. In this example, class C networks are assumed.

3.6.4 Setting the Domain Name

Domain name is the name given to the group of hosts controlled by NIS (Network Information Service: system which integrates/controls the database such as */etc/passwd* and */etc/hosts* files within the network.) Domain name is actually the name given to the group of databases controlled by NIS. Currently, domain name is referred only by NIS . Usually, domain name is specified in the file */etc/rc.custom* of each workstation automatically when the system is activated. Therefore, modify the */etc/rc.custom* file if you want to specify the domain name.

You will find the following line in file */etc/rc.custom*.

```
# HOSTNAME: hostname of this machine. The name must be described in /etc/hosts.
#                HOSTNAME must be specified
HOSTNAME=myname.my.domain

# DOMAINNAME: the name of NIS domain, also used by sendmail.
#    ''                    no domainname, NIS is not used.
#    <anything else>              NIS domain
DOMAINNAME=noname

# BROADCAST: broadcast address for primary network, should be specified only
# when non-standard broadcast address is used.
#    'my-broadcast' or ''     use default broadcast address (host part: 1)
#    (ex.192.43.189.0)        use old or non-standard broadcast address
BROADCAST=my-broadcast

# NETMASK: sub-network mask pattern for primary network.
#    'my-netmask' or ''       subnet mask is not used
#    (ex.255.255.255.0)       subnet mask
NETMASK=my-netmask
```

For example, set *myname.my.domain* field to the user machine name specified in the */etc/hosts* file, *noname* of DOMAINNAME to *news*, *my-broadcast* of BROADCAST to the user's BROADCAST address specified in the */etc/hosts* file, and *my-netmask* of NETMASK to 255.

/etc/rc.custom file will become as follows:

```
# HOSTNAME: hostname of this machine. The name must be described in /etc/hosts.
#                HOSTNAME must be specified.
HOSTNAME=nws0

# DOMAINNAME: the name of NIS domain, also used by sendmail.
#    ''                    no domainname, NIS is not used.
# <anything else> NIS domain
DOMAINNAME=news
```

```
# BROADCAST: broadcast address for primary network, should be specified only
# when non-standard broadcast address is used.
#       'my-broadcast' or ''          use default broadcast address (host part: 1)
#       (ex.192.43.189.0)             use old or non-standard broadcast address
BROADCAST=101.0.0.0

# NETMASK: sub-network mask pattern for primary network.
#       'my-netmask'or ''             subnet mask is not used
#       (ex.255.255.255.0)            subnet mask
NETMASK=255.255.255.0
```

For more information, refer to *domainname* (1) in On-Line Manual.

3.6.5 Setting the Network Command Permission

If you want to execute command from other workstations connected to the network via **rsh** (remote shell), you must set the remote host name in the following files:

1. /etc/hosts.eqiv

To allow command execution to all users except super users, write the remote host name to which execution is allowed. In this case no password will be checked if a **login** is requested from other workstation using **rlogin** (remote login) command. However the remote host name is written in the file */etc/hosts.equiv*, no access will be allowed via **rsh** if the remote host user is super user and password will be checked in case of **rlogin**.

2. File .rhosts under the home directory of each user

For super users, the */etc/hosts.equiv* file will not be checked; instead the *.rhosts* file will be checked. Otherwise, both */etc/hosts.equiv* and *.rhosts* files under the home directory of each user will be checked. Command execution will be allowed using **rsh** from the host specified in one of these files. In case of **rlogin**, no password will be checked.

Example:
Suppose that the contents of */etc/hosts.equiv* file on *nws0* are:

```
nws0
nws1
```

and the contents of the */.rhosts* file are:

```
nws0
nws2
nws2  operator
```

The contents of the *.rhosts* file under the home directory of user named *guest* are:

```
nws0
nws1
nws1  demo
nws2
```

The following users are allowed to execute commands using **rsh** and to login without password check:

Remote host name	User name on remote host	User ID for execution
nws0	root	root
nws2	root	root
nws2	operator	root
nws0	guest	guest
nws1	guest	guest
nws1	demo	guest
nws2	guest	guest

As shown above, non-super user may become a super user on the remote host according to setting of *.rhosts* file. Therefore, you must be careful when setting these files. The following diagram shows the relationships between the super user, */etc/hosts.equiv*, and */.rhosts* files

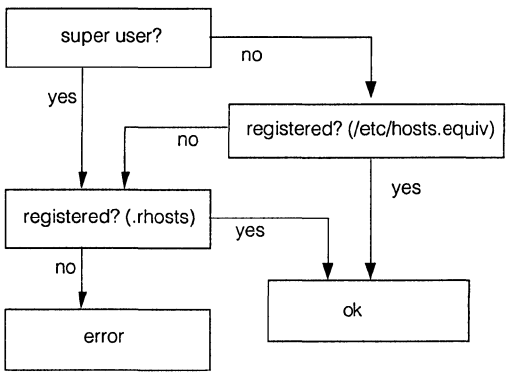


Figure. Relationships between the super user, */etc/hosts.equiv*, and */.rhosts*

[Note]

Users not registered in the */etc/ password* file cannot link up to NEWS for remote processing.

3.6.6 RS-232C Network

You may setup a network using the RS-232C cable. You may also setup a network using a modem. The concept is the same as with Ethernet, but "en0" is changed to "sl0" in **ifconfig** specification. This section assumes that all of the networks described so far have been established and describes how to connect hostA and hostB using RS-232C cable. Only the super user is allowed to connect to the network interface.

Setting:

To set RS-232C network, follow the steps shown below:

# su	
# netstat *–i*	Confirm the device driver for RS-232C.
Confirm of */etc/ttys*	Confirm that tty0 cannot login.
# slattach *tty00 9600*	Connect using 9600bps rate.
# ifconfig *sl0 hostA hostB up*	Specify hostA and hostB.
# netstat *–i*	Confirm sl0.

Stopping:

To stop RS-232C network, follow the steps shown below:

# su	
# ifconfig sl0 down	Shut down the RS-232C interface.
# ps *ax* | grep *slattach*	Search the slattach PID.
# kill *PID*	Kill the slattach process.

3.6.7 NIS (Nerwork Information Service)

NIS system is intended to share control files under each workstation on the network and to integrate file management.

/etc/hosts
/etc/passwd
/etc/group
/etc/hosts.equiv
/etc/networks
/etc/protocols
/etc/ethers
/etc/services
/etc/netgroup

NIS system has a master server and several slave servers.

3.6.8 Setting NIS Master Server

There is only one master server in NIS domain.

The master server has the following control files under "/etc". You may set those files in any order.

1) Set the files shared by NIS.

2) Initialize the NIS system via **ypinit** **–m**.

Enter slave server names as many as you need.

3) Modify */etc/rc.custom* file as follows:

```
# NIS: network information service (NIS)
#       'm.server'              NIS master server
#       'server'                NIS slave server
#       'client'                NIS client
#       <anything else>         NIS is not used
NIS=m.server
# NET: using network
#       'off'                   No networks are used
#       <anything else>         Networks are used
NET=on
```

4) Reboot using **shutdown** **–r**.

3.6.9 Setting NIS Client Group

Set the NIS client group as follows:

1) Confirm */etc/hosts* file

2) Modify */etc/rc.custom* file as follows.

```
# NIS: network information service (NIS)
#       'm.server'              NIS master server
#       'server'                NIS slave server
#       'client'                NIS client
#       <anything else>         NIS is not used
NIS=client
#       NET: using network
#       'off'                   No networks are used
#       <anything elese>        Networks are used
NET=on
```

3) Reboot using **shutdown** **–r**.

3.6.10 Slave Server Setting

Several slave servers may exist. Each slave server has copy of control files under "/etc" of the master server as internal NIS format via **ypinit**. Set the NIS slave servers as follows:

1) Execute :**ypinit** –s *master_server_name.*

2) Modify */etc/rc.custom* file as follows.

```
# NIS: network information service (NIS)
#       'm.server'          NIS master server
#       'server'            NIS slave server
#       'client'            NIS client
#       <anything else>     NIS is not used
NIS=server
#NET: using network
#       'off'               No networks are used
#       <anything else>     Networks are used
NET=on
```

3) Reboot using **shutdown** –r.

3.7 NFS Setting

This section describes the setting of the NFS. As an example, the file system */usr* of the machine with host name "serv" is mounted and used on the directory */usr* of the machine with host name "client". This section assumes that you have completed the setting of host name, IP address, and NIS.

3.7.1 Setting NFS Server

To set the machine as an NFS server, follow the procedure described below.

3.7.1.1 Setting */etc/exports* file

The information concerning access rights such as which workstation is allowed to remote-mount on which file system is described in the */etc/exports* file

An example of */etc/export* file:

```
/usr        -access=clients              # export to my clients
/usr/local                               # export to the world
/usr2       -access=hermes:zip:tutorial  # export to only these machines
/usr/sun    -root=hermes:zip             # give root access only to these
/usr/new     -anon=0                     # give all machines root access
/usr/bin    -ro                          # export read-only to everyone
/usr/stuff  -access=zip,anon=-3,ro       # several options on one line
```

For more information about the */etc/exports* file, refer to ***exports*** (5) in On-Line Manual.

3.7.2 Setting NFS Client

To set the workstation as an NFS client, use the following procedures described next.

3.7.2.1 Normal Mounting

Example:

To mount a local disk

```
% mount /dev/hp0g /usr
```

To mount all 4.3 filesystems

```
% mount -at 4.3
```

To mount a remote filesystem

```
% mount -t nfs serv:/usr/src /usr/src
```

To hard mount a remote filesystem

```
% mount -o hard serv:/usr/src /usr/src
```

To save current mount state

```
% mount -p > /etc/fstab
```

To mount a CD-ROM drive

```
% mount -t cdfs /dev/sd06c /cdrom
```

To mount MS-DOS 720-Kbyte floppy disk

```
% mount -t pcfs dev/fd01a
```

3.7.2.2 Remote Mounting at the Time of System Activation

The */etc/fstab* file contains entries for file systems and disk partitions to mount using **mount** command, which is normally invoked by the **rc.boot** script at boot time. This file is used by various utilities that **mount**, **unmount**, check the consistency of **dump**, and **restore** file systems.

An example of */etc/fstab* file:

In the following example, the */var/home/usr* directory is hard mounted, read-write over the NFS, along with additional swap space in the form of a mounted swap file (see for details on adding swap space).

/dev/sd00a	/	4.3	rw	1	1
/dev/sd00h	/usr	4.3	rw	1	2
/dev/sd00e	/var	4.3	rw	1	3
/dev/sd00d	/tmp	4.3	rw,delay	1	4
/dev/sd00f	/export	4.3	rw	1	5
example: /var/home/usr	/var /home/usr	nfs	rw,hard,fg	0	0
/export/swap/myswap	swap	swap	rw	0	0

After edit */etc/fstab* file, attempt to mount all the filesystems described in */etc/fstab* as follows.

```
% mount -a
```

If you change "rw" to "ro", the directory is mounted as read only. For more information about the file */etc/fstab,* see *fstab* (5) in On-Line Manual.

3.7.2.3 automount

automount is a daemon that will automatically and transparently mount an NFS file system whenever a file or directory within in that system is opened. **automount** forks a daemon, which appears to be an NFS server to the kernel; lookups on the specified directory are intercepted by this daemon, which uses the map contained in mapname to determine a server, exported file system, and appropriate mount options for a given file system. The named map can either be a file on the local system, or a NIS (Network Information Service) map. directory is a full pathname starting with a '/'.

```
% automount /homes -passwd
```

then if the home directory shown in the passwd entry for the user username has the form */dir/server/username*, and server matches the host system on which that directory resides, references to files in */homes/username* result in the file system containing that directory being mounted if necessary, and all such references will refer to that user's home directory.
For more information about **automount,** refer to *automount* (8) in On-Line Manual.

3.8 UUCP System Setting

3.8.1 Connecting 2 NEWS Terminals via UUCP (Cross Cable Direct Connection)

"/dev1/tty00" of host name *news1* is directly connected to "/dev/tty01" of host name *news2* via a cross cable to allow data to be exchanged with 9600bps rate. Note that the master always initiates the slave to perform UUCP work.

• **su**	Setting of the master (*news1*)
vi */etc/ttys*	Terminate getty of tty00.
kill *-HUP 1*	"kill –1 1" is also acceptable
chmod *660 /dev/tty00*	Authorization information about tty00, owner, group replacement
chown *uucp /dev/tty00*	
chgrp *daemon /dev/tty00*	
vi */usr/lib/uucp/L-devices*	Add one line.
vi */usr/lib/uucp/L.sys*	Add one line.
exit	

To terminate **getty,** change <tty00 "/etc/getty std.9600" unkown on secure > to <tty00 none unknown off secure>.
Add a line <DIR tty00 unused 9600 direct> to the file *L-devices.*
Add a line <news2 Any DIR 9600 tty00" "P_ZERO" "CR ogin: – CR-ogin: uunews1 ssword: *my-password*> to the file *L.sys.*

If the same line exists already, you may leave as it is. *my-password* is an arbitrary password.

• **su**	Setting of the slave (*news2*)
vi */etc/ttys*	Set tty01 to run **getty** with 9600bps.
kill *-HUP 1*	"kill –1 1" is also acceptable.
vipw	Add the user entry *"uunews1".*
passwd *uunews1*	Specify password *my-password* for *"uunews1".*
vi */usr/lib/uucp/L.sys*	Add one line.
exit	

Contrary to the master; to run **getty**, change <tty01 none unknown off secure> to <tty01 "/etc/getty std.9600" dialup on>. To use **vipw**, copy the existing user entry named "uucp" and replace the user name with *"uunews1".* Although the password *my-password* is specified, you may

specify arbitrary password instead. However, this password should match the *L.sys* password (the last character string) of the master.

Add <news1 Never Slave> to file *L.sys.* of the slave.

3.8.2 Connecting 2 NEWS Terminals via UUCP (Via 2400 bps modem, Hayes specifications)

The local setting is similar to cross cable direct connection. Use 2400 bps modem of Hayes specifications and connect *news1* and *news2* via telephone line. Suppose *news1* calls up *news2,* the telephone line of *news1* is tone line, and the telephone number of *news2* is 03-3448-4018. Note that modem must be set so that carrier detection appears on DCD of RS-232C and the line is disconnected when DTR drops.

• **su**	Setting of the master (*news1*)
vi */etc/ttys*	Terminate getty of tty00.
kill *-HUP 1*	"kill -1 1" is also acceptable
chmod *660 /dev/tty00*	Authorization information about tty00, owner, group replacement
chown *uucp /dev/tty00*	
chgrp *daemon /dev/tty00*	
vi */usr/lib/uucp/L-devices*	Add one line.
vi */usr/lib/uucp/L.sys*	Add one line.
exit	

To terminate **getty**, change <tty00 "/etc/getty std.9600" unkown on secure> to <tty00 none unknown off secure>.

Add <DIR tty00 unused 2400 direct> to the file *L-devices.*

Add <news2 Any DIR 2400 tty00 " " P_ZERO" "AT OK ATDT03-3448-4018 CONNECT CR ogin: -CR-orin : uunews1 ssword : my-password> to the file *L.sys.*

• su	Setting of the slave (*news2*)
vi */etc/ttys*	Set tty00 to run **getty** with 2400bps.
kill *-HUP 1*	"kill -1 1" is also acceptable.
vipw	Add the user entry *uunews1*.
passwd *uunews1*	Specify password "my-password" for *"uunews1"*.
vi */usr/lib/uucp/L.sys*	Add one line.
exit	

To run **getty**, change <tty00 none unkown off secure> to <tty01 "/etc/getty std.2400" dialup on>. Add <news1 Never Slave> to the file *L.sys* regardless of the baud rate.

3.8.3 Testing the Connection

```
• su
/usr/lib/uucp/uucico -rl -snews2 -x5
exit
```

This command confirms whether the UUCP has been successfully established. This command line should be executed from the master (*news1*). If this command executes normally, the following message will be displayed at the end:

```
conversation complete
```

3.8.4 Troubleshooting (if connection test fails)

```
• ls -l /dev/tty00
view /usr/lib/uucp/L-devices
ls -li /usr/spool/uucp | grep LCK
```

If <port can't open> or <port busy> message appears, tty00 allocation failed. In case of <port can't open>, make sure that tty00 owner is uucp, group is daemon, and authorization information is set to "rw-rw...". Reconfirm the tty00 entry in the file */usr/lib/uucp/L-devices*.
In case of <port busy>, make sure there is no lock file started with "LCK" and ended with "tty00" as */usr/spool/uucp/LCK/LCK..tty00*. If such a file exists, delete it.

```
• view /ust/lib/uucp/L.sys
```

If the master fails to login to the slave, confirm the communication parameters first. Setting of "P_ZERO" in the file *L.sys* is based on assumption that *news2* getty works in 8-bit mode. If the *getty* is in 7-bit mode, remove

```
P_ZERO "" 
```

from the file *L.sys*. Note that **uucico** defaults to 7-bit even parity.

If you find any unreadable character in string sent from *news2*, confirm the speed of *news2* getty. Also confirm that *news1* can login to *news2* using **tip**. If processing speed of *news2* is slow so that *news1* cannot catch the login prompt ("login:"), it may be a good idea to insert a delay immediately after sending the CR.

```
CR\d\d
```

The system will wait about two seconds after sending the CR.
If login to the slave fails, try using the **tip** (explained above). First to align the character strings to be received and to be transmitted. Try to see how it works anyway.

3.8.5 Starting the Regular Operation

- su
  vi /*usr/lib/crontab*
  exit

The UUCP system is set so that it is connected regularly by **cron**. For example, to connect the UUCP at every hour on the hour (24 times/day), add the following line to the file */usr/lib/crontab*.

```
0 * * * * uucp /usr/lib/uucp/uucico -rl -snews2
```

If you add the following line:

```
30 0,8,16 * * * uucp /usr/lib/uucp/uucico -rl -snews2
```

The UUCP is connected at 0:30, 8:30, and 16:30.

[Note]

The following is the list of words you may specify on the transmission field of the file *L.sys*:

P_ZERO	Set the parity to zero.
P_EVEN	Set even parity.
P_ODD	Set odd parity.
CR or \ r	Carriage return (0x13).
BREAK	Send the BREAK signal.
SLEEP.n	Wait for n seconds.
\d	Wait for 1 second.

If connection fails, refer to the modem manual and make sure that it set correctly.

3.9 Preparing Gateway with Additional Ethernet Board

This section describes how to prepare a gateway using an additional Ethernet board. A gateway is used as a bridge between networks and is considered to be a repeater.
Follow the setting instruction given below.

- su

```
mkhosts /etc/hosts
vi /etc/rc.net
ps ax | grep gated
who
ps aux | more
fastboot
```

Two files are set here. If you want to make a gateway by adding an Ethernet board to news1

① of hosts file in:

```
127.1          localhost loghost
234.0.3.1      john ..... ①
234.0.3.2      dave ..... ②
234.0.3.3      mary
```

The line ① will be replaced with the following two lines:

```
234.0.3.1      john       john-C ..... For network C
234.0.4.203    gate3-4    john-D ..... For network D
```

Note that the host name "gate3-4" (any unique name is acceptable) is only used to set a gateway via the **ifconfig** or **route** command. Only "john" is usually used in other command lines.
However "john" and "gate3-4" can be considered as two network terminal names, one of them is selected to be used as the host name to identify the machine. Same applies to the associated IP address.
If an Ethernet board is added to the workstation with host name "dave" and is used as the gateway to network B, ② shown above will be replaced with the following two lines:

```
234.0.3.2      dave       dave-C ..... For network C
234.0.2.203    gate2-3    dave-B ..... For network B
```

The /etc/hosts file should be changed as follows:
Note that "gate3-4" can be specified as "john-D".
If an Ethernet board is added to "dave" workstation, */etc/rc.net* file of "dave" workstation should be changed similarly. However, "gate 3-2" (or "dave-B") should be rather than "gate3-4".
When */etc/hosts* and */etc/rc.net* files are modified, copy the */etc/hosts* file to all workstations on the network. In case of NEWS-OS Release 4.0, every workstation must execute **"mkhosts /etc/hosts"**. In addition, make sure that **gated** will run using **ps**, confirm status of each workstation using **who**, and reboot all workstations. If **gated** is not running, check the following description in */etc/rc.custom* and */etc/rc.net* files. If you find "#" placed at the beginning of each line, delete them. If you do not find such description, add them.

In */etc/rc.custom* file, set router or gateway name as follows.

```
# ROUTER: gateway or routing daemon
#       'gated'                 use 'gated' routing daemon
#       'routed'                use 'routed' routing daemon
#       'my-router' or ''       no routing are used
#       <the name of gateway>   use the name as default gateway
ROUTER=gated
```

Setting up Ethernet interfaces in */etc/rc.net* file via */etc/rc.custom*

```
if [ -n "$HOSTNAME" -a "$HOSTNAME" !=myname.my.domain]; then
        if [ -n "$NETMASK" -a "$NETMASK" !=my-netmask]; then
                ifconfig en0 $HOSTNAME -trailers up netmask $NETMASK
        else
                ifconfig en0 $HOSTNAME -trailers up
        fi
        if [ -n "$BROADCAST" -a "$BROADCAST" !=my-broadcast]; then
                ifconfig en0 broadcast $BROADCAST
        fi
        ifconfig en0                    >/dev/console
fi
```

Setting up Ethernet interfaces in */etc/rc.net* file as follows.

```
# ifconfig en1 up -trailers myname_en1
# ifconfig en1                          >/dev/console
```

Modify *myname_en1* to "gate3-4" and delete a comment mark, #.

```
ifconfig en1 up –trailers gate3-4
ifconfig en1 >dev/console
```

[Note]

The host connected to other network via the gateway must know the path information such as name of the gateway workstation, name and address of the network connected to other side of the gateway. Otherwise, the host is not able to exchange data with other network. **gated** is a daemon which automatically collects and controls such path information. It writes information not collected automatically into */etc/gated.conf*. For more information, refer to ***gated*** (8c) in On-Line Manual.
If **gated** cannot be executed due to some reason (such as bug or network restriction), execute the **route** command with */etc/rc.net* in stead of supplying the path information. The formfat of the **route** command is:

Setting routing table in */etc/rc.net* file via */etc/rc.custom*

```
if [ "$ROUTER" = gated –a –f /etc/gated]; then
                    echo 'starting routing daemon'          >/dev/console
        /etc/gated
elif ["$ROUTER" = routed –a –f /etc/routed]; then
                    echo 'starting routing daemon'          >/dev/console
        /etc/routed
elif [–n "$ROUTER" –a "$ROUTER" !=my-router]; then
        OLDGW='netstat –n –r | grep 'default' | awk '{ print $2}'
        if [ –n "$OLDGW"]; then
                    route delete default $OLDGW             2>&1 >/dev/console
        fi
        route add default $ROUTER 1                         2>&1 >/dev/console
fi
```

If you specify the metric count, the packet is restricted not to pass the gateway more than the specified number of counts. For the network name, refer to */etc/networks*.

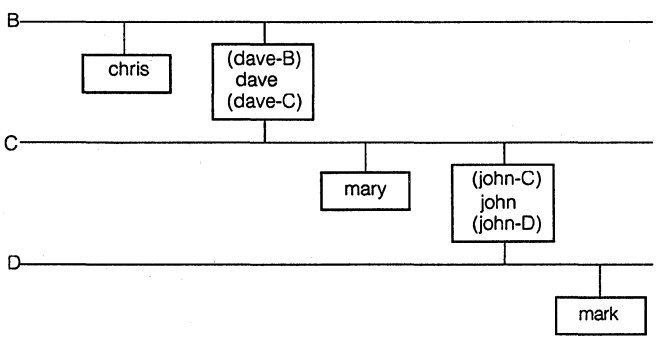
Based on route setting, if the network address part of IP address of a packet is the specified destination network address, the address will be sent to the gateway host.
For example, let's look at the setting example of the network introduced in this section. The file */etc/hosts* is finally looks like:

```
127.1           localhost       loghost
234.0.2.203     gate2-3         dave-B
234.0.3.1       john            john-C
234.0.3.2       dave            dave-C
234.0.3.3       mary
234.0.4.203     gate3-4         john-D
```

Further if you connect the workstation with host name "chris" to network B and workstation with host name "mark" to network D. Then let **route** command run on each workstation as shown below, **routed** and **gated** are no longer required.

```
chris:
        route add news-netC dave-B    1
        route add news-netD dave-B    2
dave:
        route add news-netD john-C    1
mary:
        route add news-netB dave-C    1
        route add news-netD john-C    1
john:
        route add news-netB dave-C    1
mark:
        route add news-netB john-D    2
        route add news-netC john-D    1
```

For example, the first line of chris can be interpreted as 'To connect with news-netC host, send a packet to dave-B gateway'.
If you delete first and second lines from "chris", "chris" and "dave" can still communicate each other since both are connected to network B. However, "chris" cannot communicate with the hosts ("mary", "mark") which are connected to the networks other than network B since there is no router to connect from network B to network C and D. The relationships of above mentioned networks are shown:



3.10 Invoking UNIX or BBS System via Serial Line and Modem

3.10.1 Connect a Line and Establish a Session

- tip out

tip connects local tty terminal to remote tty terminal via RS232C line or further using a modem via telephone line. The unix system on a remote workstation or general BBS system can be invoked. Note that **tip** allows use of Japanese language in case of NEWS-OS Release 4.0.
tip-name is an example of communication name for **tip** This should be described in the file */etc/remote*.

```
tip-name:\
        :dv=/dev/tty01:br#1200:\
        :el= ^U ^C ^R ^O ^D ^S ^Q@ : ie=#%$:
```

If *tip-name* is set as above, number 1 of RS-232C line performs communication tasks with 1200 baud rate. If UNIX workstations are directly connected via RS-232C, the login prompt immediately appears. Note that NEWS-OS Release 2.X differs from NEWS-OS Release 4.0 in */etc/ttys* setting. For NEWS-OS Release 4.0, it should be set as follows by the workstation which activates tip:

```
tty01 none unkown off secure
```

And the workstation to be logged in should be set it as follows:

```
tty01 "/etc/getty std.1200" unkown on secure
```

For NEWS-OS Release 2.X, set as follows respectively:

```
02tty01
12tty01
```

When you have completed login to the UNIX workstation or BBS system, you may freely execute command line as on each system.
To end the communication via **tip**, line feed and enter "~." Or you may enter CTRL-D after "~" to stop.
If you enter CTRL-Z after "~", **tip** is temporarily stopped and mode is switched to local. At this time, **tip** waits in background. In this case, communication can be resumed via the **fg** command.

3.10.2 File Transfer

The following command lines can be executed while communication to the UNIX system takes place via **tip**:

- ~p *foo*

The file named "foo" of the local workstaion is copied to the current directory of the remote workstation.

- ~t *foo*

The file named "foo" of the remote workstaion is copied to the current directory of the local workstation.
[Notes]
Tip of NEWS-OS Release 2.X communicates in 7-bit mode which does not pass the highest bit. Generally, tip does not transfer binary file.

3.10.3 Protocol Using Modem and Hayes AT Command

To connect to a remote system using **tip**, enter as follows:

% **tip** *tip-name*

If it is directly connected, the remote system login prompt will appear immediately. If a modem is used, messages can be exchanged with the modem. As an example of modem use, interaction when Hayes AT comman is used is shown below:

```
% tip tip-name
connected . . . . . Press the RETURN key several times.
ATDT0334484018 . . Dial the phone number [03-3448-4018]
                   Press the RETURN key several times.
login: . . . . . Connection completed.
                   If you start from dial zero, dial "ATDT0,0334484018".
```

If connection is made successfully, you now enter the login sequence of the remote system. Thereafter, you can use the terminal currently using as the remote system terminal. If you logged out, you return to the modem session. You may then dial again or enter "~." to terminate **tip**.
tip does not only connect to the remote system but also provides internal commands such as file copy between local and remote. The internal commands as shown next always start with "~". It is used to interpret whether the input character string should be sent to the remote system or handled as the internal command*1. Therefore, you must feed a new line before entering these internal commands.

~p <file name1> [<file name2>]

Copies <file name1> from the local system to the file with same name on the remote system (put). If you specify <file name2>, file is copied to <file name2>.

~t <file name1> [<file name2>]

Copies <file name1> from the remote system to the file with same name on the local system (take). If you specify <file name2>, file is copied to <file name2>.
These two commands cannot be executed if you are connected to a system other than UNIX because they use the **cat, stty,** and **echo** commands on the local/remote system*2.

~|

Executes the remote system command and connects the output to the local system via **pipe**. This allows you to execute **lastcomm** on the remote system and to process the output using **wc** on the local system. Note that each command line for each system is specified interactively after execution of ~|.

~?

Generates the list of internal commands.

~^Z

Suspends **tip** execution and returns you to the local system. You can resume the remote system session via **tip** if you execute the **fg** command.

~^D or ~.

Terminates **tip**.
You may change "~", internal command indicator to another character. To do this, add "escape=<character>" to the file *.tiprc* in the home directory*3. A lock file (file name starts with LCK) is generated and remained in */usr/spool/uucp/LCK* when you execute **tip**. You must delete such lock file before you execute **tip** again. Otherwise, you cannot execute **tip**. To avoid this, activate another process which automatically deletes such lock file at the end when you execute **tip***4.

*1 If a character following a Carriage Return or el (End of Line) defined in the file */etc/remote* is "~", it is assumed that the string after "~" is an internal command.
*2 If you use "~<" or "~>" internfal command, file can be exchanged with non-UNIX system. See *tip* (IC) in On-Line Manual.
*3 "~s" internal command is also acceptable.
*4 These tasks are performed by super user.

Refernces:
"Unix Workstation NEWS" page 287-289: ASCII Corporation. Copyright (C) 1987 Shouji Inoue, Hiroyuki Ohno,Naoki Nagira, Masato Minda, and Kenshirou Ikeda.
"Unix Workstation NEWS OS System Work book" page 228 ~ 232, 305 ~ 309, 223 ~ 224:
ASCII Corporation. Copyright (C) 1988 Shoji Inoue, Hiroyuki Ohno, Akiya Ishida, Yuhji Matsumae, and Masahiro Takei.

II

Setting up a Diskless Workstation

TABLE OF CONTENTS

II. Setting up a Diskless Workstation

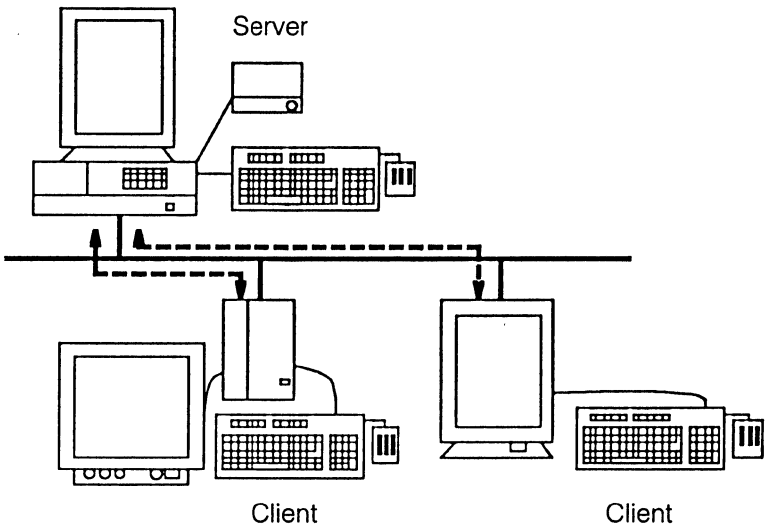
3.11 Introduction

This section explains how to set up the Server/Client when using the NEWS Series diskless workstations.

The workstation which is to be the Server should have NEWS-OS Release 4.0 installed.

3.11.1 What is a Diskless Workstation?

A diskless workstation is similar to an ordinary workstation in that it contains calculation and graphic control functions. However, a diskless workstation does not contain an independent hard disk. A diskless workstation obtains the programs and data via network connection from the hard disk of the Server workstation. The diskless workstation used in this way is called the "Client" and the workstation that supplies disk space to the diskless workstation is called the "Server".



When booting the Client, all of the Client data including the program and the kernel program must be downloaded from the Server.

To support the Client of a diskless workstation, the Server workstation must reserve a portion of the hard disk specially for the Client files.

3.11.1.1 Types of Diskless Workstations

The NEWS Series contains the following types of diskless workstations.

CISC NEWS		RISC NEWS
NWS-711	NWS-1510	NWS-3410
NWS-712	NWS-1710	NWS-3710
NWS-721		
NWS-811		

3.11.1.2 Limitations in Setting up a Diskless Workstation

CISC NEWS will not be used as a Server when the Client is RISC NEWS.

3.11.1.3 Where to Place the Client File System

To add a Client's file system, a Server must have at least the following disk capacity per Client.

Diskless Workstation	Necessary Space
CISC NEWS	30~60 Mbytes
RISC NEWS	45~90 Mbytes

These disks are distributed among the Client's root file system, the swap area, and the */var* file system. The file system name and how each file system is mounted are entered in the file */etc/fstab*. (refer to *fstab* (5) in On-Line Manual for more information).
Here an example is given of the usual file system when the NEWS-OS is installed.

An example of */etc/fstab* file

```
/dev/sd00a    /        4.3 rw        1    1
/dev/sd00d    /tmp     4.3 rw,delay  1    2
/dev/sd00e    /var     4.3 rw        1    3
/dev/sd00f    /export  4.3 rw        1    4
/dev/sd00h    /usr     4.3 rw        1    5
```

The various default partition sizes of the hard disk supported by the NEWS workstation are entered in the file */dev/disktab* (refer to *disktab* (5) in On-Line Manual for more information).
When a file system is made on a new disk, such as adding a hard disk, use the values entered in this file. The disk type of the hard disk installed with a standard installation is **hdsd***xx_yy*.

For example, with an internal hard disk of 1280 Mbytes, the disk type is hdsd00_1280. This disk name (other disk names are also listed in file */etc/disktab*) is used with the **newfs** command (See *newfs* (8)) at the time of constructing a partition on a hard disk which has been formatted.

The hard disk partition size and its usability can be seen by using the **df** command. Here is shown the information of a workstation that has an internal hard disk of 1280 Mbytes.

```
# df
Filesystem      kbytes      used     avail    capacity    Mounted on
/dev/sd00a        7341      4028      2578         61%    /
/dev/sd00h      271474    203894     40432         83%    /usr
/dev/sd00f      548078         9    493261          0%    /export
/dev/sd00e      271595       130    244305          0%    /var
/dev/sd00d        7341         9      6597          0%    /tmp
```

After looking at the partition size, the total disk capacity, and the available space on the disk, then decide where to construct a Client's file system. Since the disk space of partition **f** is almost unused, assign it to a diskless workstation. Some disk space on the expansion hard disk connected to the Server can also be assigned.

3.11.1.4 Setting up a Diskless Workstation

In setting up a diskless workstation, it is necessary to construct a Client's file system on a Server disk.

A regular setup of the Server is implemented in the following layout.

- A diskless workstation file is read in from the NEWS-OS Release 4.0 Installation Kit
- Decide the setup method (NFS or Remote disk)
- Enter the information concerning the Server and Client network address (Server name, each Client name, hardware address, and Internet address name)
- Modify the files referred to by daemons
- Modify the files concerned with the Client's file system
- From each Client's file system copy the boot programs needed by the Server, define the NFS file systems which can be utilized by each Client, and construct necessary file systems.
- Modify the Client's file

3.11.2 Types of Setups

The following are methods of setting up a diskless workstation.

- Using the root file system and the swap area with the NFS
- Using the root file system and the swap area with the remote disk

3.11.2.1 Utilizing NFS

The root file system and the swap area are used with the NFS, which is supported by the NEWS-OS Release 4.0. The particulars of using NFS are:

- The safety of the Client's file system is high
- In comparison to the remote disk, its file access is relatively quick
- Complicated operations such as **newfs** are not required

For these reasons it is recommended to use NFS for the root file system and the swap area in NEWS-OS Release 4.0.

Usage of the root file system and the swap area with the NFS can be realized by booting through tftp protocol. Booting through tftp protocol will hereinafter be called *tftp boot.*

The manner of setting up the tftp boot differs depending on whether or not the Client's ROM monitor supports the tftp boot.

The followings are the workstations with ROM monitors that support the tftp boot.

NWS-3400 Series
NWS-3700 Series

When the ROM monitor of the Client supports the tftp boot.

When the Client's ROM monitor supports booting through the tftp protocol, a boot program can be loaded without setting up a remote disk. Following is an explanation of the process up until the kernel program starts up.

1. To find the Client's Internet address, the Client's ROM monitor issues the **bootp** request (bootstrap protocol) containing the hardware address information.

2. The *bootpd* in the network identifies the Client and returns the Internet address and the boot program file name. This boot program file name is the name entered in the */etc/bootptab* file (Here the name is */tftboot/tftpboot.mips*).

3. When the Internet address and the boot program file name are received, the Client, using tftp protocol, requests the Server for the boot program.

4. The Server sends the Client's boot program through the network.

5. The Client then boots with this boot program. Using tftp protocol, this boot program ask the Server for the *vmunix,* whose file name is in the following format:

   (Client Internet address in hexadecimal) + . + (machine type)

   An example of *vmunix* file name: 65001f25.news3400

6. The Server searches for the Client's *vmunix* file name from the */tftpboot* directory. This file is copied from */sys/OBJ.news3400/nfsvmunix* beforehand.

   # cp –p /sys/OBJ.news3400/nfsvmunix /tftpboot/65001f25.news3400

   In order to save some disk space, it is recommended that directory */tftpboot* is constructed in the same file system used by the Client's root file system, and then the file is hard linked to the kernel program in the Client's root file system.

7. When the kernel program starts up, request "reverse-arp" having hardware addresses is issued in order to find the Client's Internet address. (It will try to obtain its own IP address by using *rarp* protocol).

8. The reverse-arp Server in the network identifies the Client and returns the Internet address.

9. By broadcasting, inquire as to the whereabouts of your own file system in the *bootparamd.*

10. Mount the root as NFS, open the swap, and then carry out normal operation.

Clients with ROM monitors that do not support the tftp boot

For a Client with a ROM monitor that does not support the boot through tftp protocol, a remote disk must be set up to load the boot program. Following is a simple explanation of the process taken up until start up of the kernel program in a Client with a ROM monitor that does not supports the tftp boot.

1. The Client's ROM monitor requests "reverse-arp" to obtain its own Internet address. The reverse-arp Server in the network identifies the Client and returns the Internet address. In order for the reverse-arp Server to identify the Client, it is necessary to set up the file */etc/ethers* on Server.

2. Once the Internet address is received, the Client seeks out the Server through **rd** protocol. In order for the Server to respond, it is necessary to set up Server's */etc/rdtab* file.

3. Identical to that of the hard disk, the boot block is read in when the Server is found.

4. The Client searches for the boot program in this block.

5. The Client is booted using this boot program. Through tftp protocol, this boot program asks the Server for the *vmunix*. Whose file name is in the following format:

   (Client Internet address in hexadecimal) + . + (Machine type)

   An example of *vmunix* file name: 65001f25.news800

6. The Server searches for the Client's *vmunix/iopboot* file name from the */tftpboot* directory. This file is copied from */sys/OBJ.news800/nfsvmunix* beforehand.

   # cp -p /sys/OBJ.news800/nfsvmunix /tftpboot/65001f25.news800

   The file name of the *iopboot* is in the following format:

   (Client Internet address in hexadecimal) + . + (Machine type) + iop

   An example of *iopboot* file name: 65001f25.news800iop

   This file is copied from file */sys/OBJ.news800/iopboot.*

   # cp -p /sys/OBJ.news800/iopboot /tftpboot/65001f25.news800iop

   In order to save some disk space, it is recommended that directory */tftpboot* is constructed in the same file system used by the Client's root file system and then it is hard linked to the kernel program in the root file system.

7. To find the Client's Internet address, request "reverse-arp" having hardware address is issued when the kernel program starts up. (It will try to obtain its own IP address by using *rarp* protocol)

8. The reverse-arp Server in the network identifies the Client and returns the Internet address.

9. By broadcasting, inquire as to the whereabouts of your own file system in the *bootparamd.*

10.Mount the root as NFS, open the swap area, and then carry out normal operation.

3.11.2.2 Utilizing Remote Disk (all models)

The setups of the root file system and the swap area through the remote disk are the same as the conventional diskless workstation setup. The particulars of using the remote disk are:

- Should the Client's power source suddenly fail, the possibility of the Client's file system being destroyed is high
- Complicated operations, such as **newfs,** come along with a Client's file system setting. Be aware that a faulty setup could lead to the destruction of the Server file system

The root file system and the swap area are used as the remote disk by booting from the remote disk rather than tftp boot. Following is an explanation of booting from the remote disk.

1. The Client's ROM monitor requests "reverse-arp" to obtain its own Internet address. The reverse-arp Server in the network identifies the Client and returns the Internet address. Set up the */etc/ethers* file on the Server so that the reverse-arp Server can identify the Client.

2. Once the Internet address is received, the Client seeks out the Server through **rd** protocol. Set up the */etc/rdtab* file on the Server in order for the Server to respond.

3. Identical to that of the hard disk, read in the boot block when the Server is found.

4. The boot block reads in the boot program */boot.*

5. Once */boot* reads in *vmunix* and *iopboot,* normal operation is carried out.

3.12 Setups Using NFS

When using the root file system and swap area with the NFS, portions of the Server setup method differ depending on whether or not the Client's ROM monitor supports tftp boot. Depending upon the CPU family relationship between Server and Client, the Client's setups may differ.

The following workstations are used as Client's to demonstrate the setup method of the root file system and swap area NFS.

Workstation	Hardware Address
NWS-3710	8:0:46:0:14:bf
NWS-711	8:0:46:0:14:c0

The following workstation is used as a Server.

Workstation	Hardware Address
NWS-3870	8:0:46:0:11:6d

When the Client is NWS-3710 and the Server is NWS-3870, they both fall under RISC NEWS; therefore, follow the example of the same CPU family. When the Client is NWS-711 and the Server is NWS-3870, the Client falls under CISC NEWS and the Server under RISC NEWS. They must, therefore, follow the example of the different CPU families.

Additionally, NWS-3710 is an example of a Client with a ROM monitor which supports the tftp boot, while the NWS-711 is an example of a Client with a ROM monitor which does not support the tftp boot.

3.12.1 Setting Up Server Files

Login as a superuser (root) to do the Server setups.

Files to be edited are as follows.

/etc/hosts
/etc/rc.custom
/etc/ethers
/etc/rc.net
/etc/bootptab
/etc/bootparams
/etc/inetd.conf
/etc/exports

The following file also must be edited when setting for a Client with a ROM monitor which does not support the tftpboot.

/etc/rdtab

3.12.1.1 Changing */etc/hosts* file

The file */etc/hosts* is a host name database which contains each host Internet address, the host name, and the alias. (refer to *hosts* (5) in On-Line Manual for more information)
When setting up a diskless workstation, each Internet address of the Server and the Client must be entered.

1. Decide the host names for the Server and the Clients.

Here, an example of host names and aliases (alias may be omitted) for Server and Client's are given.

	Workstation	Host Name	Alias
Server	NWS-3870	serv1	nws3870
Client	NWS-3710	clnt1	nws3710
	NWS-711	clnt2	nws711

2. Decide the corresponding Internet addresses for each hostname of Server and Client workstations.

In this section, the following Internet addresses are used:

Host Name	Internet Address
serv1	100.0.0.1
clnt1	100.0.0.11
clnt2	100.0.0.12

3. Change the */etc/hosts* file.

An example of the */etc/hosts* file:

```
127.1           localhost
100.0.0.1       serv1   nws3870
100.0.0.11      clnt1   nws3710
100.0.0.12      clnt2   nws711
```

4. After changing the file */etc/hosts,* execute the following command in order to make recognizable the new additions of hosts in the system (refer to *mkhosts* (8) in On-Line Manual for more information).

```
# mkhosts /etc/hosts
```

[Note]
With the NIS (Network Information Service) Client, the file */etc/hosts* is referred to at the time of system start up, so it must contain at least the localhost as well as your own entry. Add to the NIS Server when using NIS.

3.12.1.2 Changing /etc/rc.custom file

In the file */etc/rc.custom,* enter the basic information peculiar to the workstations such as the host names and domain names.

When the HOSTNAME, BROADCAST, and NETMASK of the Server are not yet setup, decide them and then change the file */etc/rc.custom* entry.

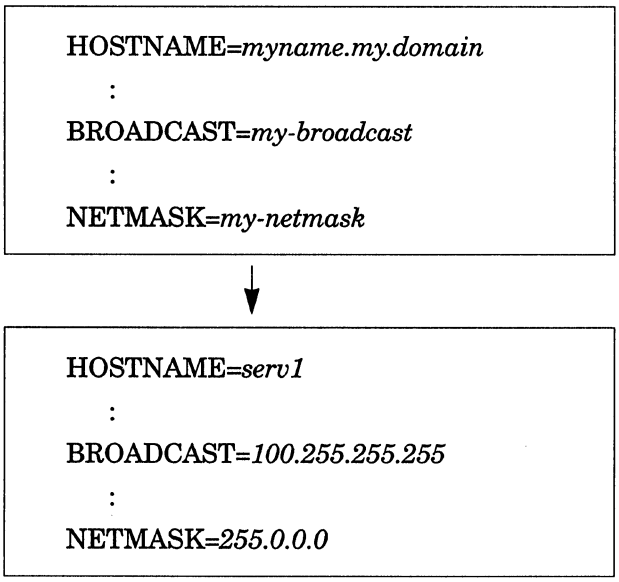
1. Set up the following parameters of a Server workstation .

   - HOSTNAME
   - BROADCAST
   - NETMASK

   These values differ depending on the system being used (refer to *ifconfig* (8) in On-Line Manual concerning BROADCAST and NETMASK).

   Here is an example with the HOSTNAME being set up as the Server host name *serv1*, BROADCAST as *100.255.255.255*, and NETMASK as *255.0.0.0*.

   Change the entrties of the file */etc/rc.custom* as follows:

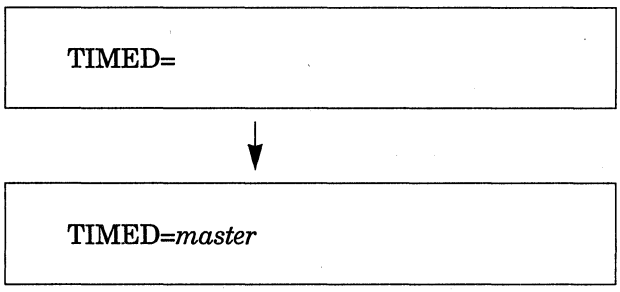


2. Set up **/etc/timed** to run as master.

   Since the Client always invokes the time Server daemon, **/etc/timed** as slave, a master time server is necessary in the network where Clients are connected (See *timed* (8)). The **timedc** command can be used to find the location where the master time server is running. Execute the command on a workstation where **/etc/timed** is running.

```
# timedc
timedc> msite
master timedaemon runs on machine
```

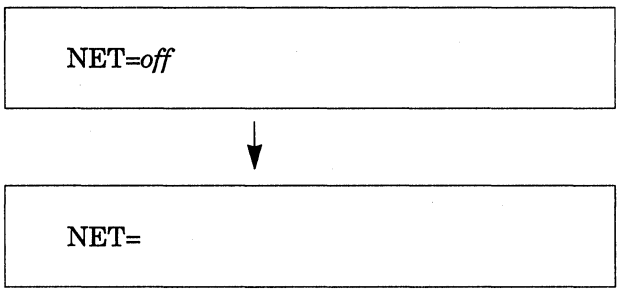
If the master time server does not exist in a network where the Client is connected, it is neccesary to startup the master time server on the Server. To startup **/etc/timed** as master, enter "master" behind **TIMED=** in the file */etc/rc.custom.* **/etc/timed** is actually invoked from the script file */etc/rc.net.* Change the entry of the file */etc/rc.custom* as follows:



3. Set up network environment.

When "off" is written behind **NET=** in the file */etc/rc.custom,* the network is unusable. In such a case, erase the word "off" or overwrite the word with different characters to make the network usable.

Change the entry of file */etc/rc.custom* as follows:



3.12.1.3. Changing */etc/ethers* file

In the file */etc/ethers,* enter hardware addresses and host names of the workstations on Ethernet. This information can be referred to by the Reverse Address Resolution Protocol Daemon */etc/rarpd.*

To use a diskless workstation, */etc/rarpd* must be running in the network. When */etc/rarpd* is running in another workstation, it is neccesary to add the Server and Client information to the file */etc/ethers* of that workstation. Should none of */etc/rarpd* is running on a workstation in the network, it is neccesary to activate */etc/rarpd* on the Server. In that case, enter the Server and Client information in the file */etc/ethers* of the Server.

[Note]
When there are several */etc/rarpd* running in the network, be sure that there is no contradiction among */etc/ethers* files of the workstations where */etc/rarpd* are running.
When there is a contradiction among */etc/ethers,* the Client system will fail to start up.

The hardware address is the information peculiar to each NEWS workstation written in the ROM of the system. This is not the same as the Internet address which is assigned at network construction. This value is also neccesary when setting up other files.

1. Confirm the Server's and the Client's hardware address. There are two ways of finding the hardware address.

   • The ROM monitor screen when power is switched on.

   An example of NWS-3870:
   SONY NET WORK STATION ***MC68030 Monitor Release 1.7***
   Model NWS-3870, Machine ID # *xxxx*, Ethernet address
   08:00:46:00:11:6d
   NEWS>

   The underlined part is the hardware address of this workstation. From this screen you can find the hardware addresses of the diskless workstations and the workstations which are not switched on.

   • The NEWS-OS screen at the time of start up

   NEWS> bo
   :
   en0: hardware address *08:00:46:00:11:6d*
   :

   The underlined portion is the hardware address of this workstation.
   Once the system starts up, this message can be confirmed with the **/etc/dmesg** command.

   % /etc/dmesg | grep *hardware*
   en0: hardware address *08:00:46:00:11:6d*

   With this method the hardware addresses of the workstations whose systems have already started up can be checked.

[Note]

Depending on the workstation, the hardware address screen will be either 08:00:46:00:11:6d or 8:0:46:0:11:6d. Either format is acceptable.

2. Change the */etc/ethers* file.

An example of file */etc/ethers:*

```
* Hardware ethernet-address      hostname
00:00:00:00:00:00                myname
```

↓

```
08:00:46:00:11:6d                serv1
08:00:46:00:11:bf                clnt1
08:00:46:00:11:c0                clnt2
```

[Note]

The */etc/ethers* file must not contain any blank line.

3.12.1.4 Changing */etc/bootptab* file

The file */etc/bootptab* is the file which is referred to by the Internet boot protocol server */etc/bootpd.*

The format of the file */etc/bootptab* is as follows:

```
myclient:\
        :ht=ethernet:\
        :ha=hardware_addr:\
        :ip=ip_addr:\
        :bf=/tftpboot/tftpboot_name:
```

Enter the Client's host name at *myclient.* Enter the Client's hardware address in two digits of hexadecimals (a to f should be capitals, and ':' should be left out) at *hardware_addr for* **ha=** entry. Enter the Internet address at *ip_addr* for **ip=** entry. If the Client's ROM monitor supports the tftp boot, enter the tftp protocol boot program name at *tftp_name* after **bf=** /tftpboot. This tftp protocol boot program is the same as */usr/mdec.mips/ftfpboot,* but can be used after copying it under */tftpboot.*

Here, the Client *clnt1* boot program name is set up in */tftpboot/tftpboot.mips.* Since the Client *clnt2* has a ROM monitor which does not support the tftpboot, this entry is unnecessary.

Change the entry of the file */etc/bootptab* as follows:

```
myclient:\
        :ht=ethernet:\
        :ha=080046000001:\
        :ip=192.43.189.2:\
        :bf=/tftpboot/tftpboot.mips:
```

↓

```
clnt1:\
        :ht=ethernet:\
        :ha=0800460014BF:\
        :ip=100.0.0.11:\
        bf=/tftpboot/tftpboot.mips:
cllnt2:\
        :ht=ethernet:\
        :ha=0800460014C0:\
        ip=100.0.0.12:
```

[Note]

The daemon */etc/bootpd* starts up when the first request arrives. When the file */etc/bootptab* is changed and an active */etc/bootpd* is already running, it is necessary to send the hangup signal SIGHUP with the **kill** command to */etc/bootpd.* By doing this, the setup file can be re-read.

3.12.1.5 Changing */etc/bootparams* file

In the file */etc/bootparams,* enter the necessary entries for the diskless clients to boot up. This information is supplied through boot parameter server */usr/etc/rpc.bootparamd.* In this file it is neccesary to enter the following information for each Client.

Client's hostname
Server's hostname
Pathname of Client's root file system on the Server
Pathname of Client's swap area on the Server
Pathname of Client's dump file on the Server (usually, this pathname is identical to that of the swap)

1. Decide where to place the Client's file system and the directory name.

   Use the **df** command to search for a place with the neccesary space for the Client's file system.

```
# df
Filesystem      kbytes      used      avail     capacity     Mounted on
/dev/sd00a        7341      4028       2578          61%     /
/dev/sd00h      271474    203894      40432          83%     /usr
/dev/sd00f      548078         9     493261           0%     /export
/dev/sd00e      271595       130     244305           0%     /var
/dev/sd00d        7341         9       6597           0%     /tmp
```

   [Note]
   Construct a hardlink from the kernel which will be placed in the root file system of the Client (described later) to the kernel which will be invoked by the boot program. Since the hardlink can not be constructed across different file systems, all Client's root file systems, must exsist in the same file system when several Clients are supported.

   In the example for the Client *clnt1*, set up the root file system directory as */export/nfsroot/clnt1* and the swap as */export/nfsswap/clnt1*. In the example for the Client *clnt2*, set up the root file system directory as */export/nfsroot/clnt2* and the swap as */export/nfsswap/clnt2*.

2. Create directories for the Client's root file system .

```
# mkdir /export/nfsroot
# mkdir /export/nfsroot/clnt1
# mkdir /export/nfsroot/clnt2
```

3. Create a Client's swap file.

   The swap file is created with the **dd** command. Please be certain the size is larger than the main memory size (if possible 2 to 4 times larger).

   [Note]
   Since the system may not work properly when the swap file size is under 33440 blocks, make sure to allocate more than 33440 blocks.

   For Client *clnt1*, create a swap file of 66880 blocks (32 Mbytes), and for Client *clnt2*, 33440 blocks (16 Mbytes). The value specified by option *seek=* of the **dd** command is the value minus 1 from the desired block size.

```
# mkdir  /export/nfsswap
# date | dd  of=/export/nfsswap/clnt1  seek=66879  conv=sync
# date | dd  of=/export/nfsswap/clnt2  seek=33439  conv=sync
```

4. Change the entry of the file */etc/bootparams.*

```
myclient  root=myserver:/nfsroot/myclient \
          swap=myserver:/nfsswap/myclient \
          dump=myserver:/nfsdump/myclient
```

↓

```
#
#       clnt1
#
clnt1           root=serv1:/export/nfsroot/clnt1 \
                swap=serv1:/export/nfsswap/clnt1 \
                dump=serv1:/export/nfsswap/clnt1
#
#               clnt2
#
clnt2           root=serv1:/export/nfsroot/clnt2 \
                swap=serv1:/export/nfsswap/clnt2 \
                dump=serv1:/export/nfsswap/clnt2
```

3.12.1.6 Changing */etc/inetd.conf* file

The file */etc/inetd.conf* is a reference file for the Internet service daemon */etc/inetd*. */etc/inetd* starts up the daemon described in this file when it receives a request.

Change the entry of the file */etc/inetd.conf*. Since the lines */etc/tftpd* and */etc/bootpd* are commented out, erase the # comment mark to enable startup of these daemons.

```
        :
# tftp    dgram udp wait root   /etc/tftpd   tftpd  -s /tftpboot
# bootps  dgram udp wait root   /etc/bootpd  bootpd
        :
```

↓

```
        :
tftp    dgram udp wait root   /etc/tftpd   tptpd  -s /tftpboot
bootps  dgram udp wait root   /etc/bootpd  bootpd
        :
```

[Note]
Please be sure that *tftpd* and *bootpd* are running on only one workstation in the network.
When the file */etc/inetd.conf* is changed and the Internet service daemon */etc/inetd* is already running, the hangup signal SIGHUP must be sent to the currently running */etc/inetd* with the **kill** command.

3.12.1.7 Changing */etc/exports* file

The directory and file entries exported to the NFS Client are recorded in the file */etc/exports* (refer to *exports* (5)). Since the Client utilizes the root file system and swap file through the NFS mount, it is necessary for the Server to export Client's directories and swap files to be used in the Client's root file system for each Client.

1. Changing the entry of the file */etc/exports* as follows:

```
/usr        -ro
/export     -ro
```

↓

```
/usr                        -ro
/export/nfsroot/clnt1       -access=clnt1,root=clnt1
/export/nfsswap/clnt1       -access=clnt1,root=clnt1
/export/nfsroot/clnt2       -access=clnt2,root=clnt2
/export/nfsswap/clnt2       -access=clnt2,root=clnt2
```

[Note]
It is impossible to export a parent directory or subdirectories when the directory has already been exported from the same file system.

2. Execute the **exportfs** command to export the added directory and file entries.

After unexporting all of the presently exported directories, export all of the entries recorded in the file */etc/exports*.

```
# exportfs -a -u
# exportfs -a
```

3.12.1.8 Changing */etc/rc.net* file

The file */etc/rc.net* is a script file holding commands which set up the network environment.

In the file */etc/rc.net,* the startup portions of */usr/etc/rpc.bootparamd* and */etc/rarpd* are commented out. Erase the # comment mark to enable startup of */usr/etc/rpc.bootpaparamd.* Also, when starting up */etc/rarpd* on the Server, erase the # comment mark to enable startup of */etc/rarpd.*

```
# if [ – f  /usr/etc/rpc.bootparamd ] ; then
#         /usr/etc/rpc.bootparamd & echo  – n ' bootparamd'        > /dev/console
# fi
          :
# if [ – f  /etc/rarpd ]; then
#         /etc/rarpd; echo  – n ' rarpd'                           >/dev/console
# fi
          :
```

```
if [ – f  /usr/etc/rpc.bootparamd ]; then
          /usr/etc/rpc.bootparamd & echo  – n ' bootparamd'        >/dev/console
fi
          :
if [ – f  /etc/rarpd ];  then
          /etc/rarpd; echo  – n ' rarpd'                           >/dev/console
fi
          :
```

3.12.1.9 Setting Up *rd* for Client whose ROM Monitor Does Not Support tftpboot.

When the Client's ROM monitor does not support the tftp boot, it is necessary to create a file system which enables a boot utilizing the remote disk.

Since the ROM monitor of the Client *clnt2* does not support tftp boot, it is necessary to set up a remote disk.

1. Set up the remote disk. When "diskless" is selected at the time of installation, the boot block and file systems which have the NFS boot codes (such as *rdfs.news700, rdfs.news800,* and *rdfs.68k*) will be installed under directory */usr/sony/etc.* The different file system is installed depending on the type of the Client.

Client	File System
NWS-700 Series	rdfs.news700
NWS-800 Series	rdfs.news800
Other CISC NEWS	rdfs.68k

[Note]

If the Client type is the same, one *rd* can be shared. For example, NWS-711 and NWS-721 can use the same *rd*. That is, you simply have to construct, at most, three types of rd for NWS-700, NWS-800, and other models of CISC NEWS when the Clients are supported. When */usr/sony/etc/rdfs.** is not present, additional installations should be done.

Changing the entries of the file */etc/rdtab* as follows:.

```
#
# rd0
#
/dev/null                    0    0    myname:0
/dev/null                    0    0    myname:1
/dev/null                    0    0    myname:2
/dev/null                    0    0    myname:3
/dev/null                    0    0    myname:4
/dev/null                    0    0    myname:5
/dev/null                    0    0    myname:6
/dev/null                    0    0    myname:7
```

↓

```
#
# rd0
#
/usr/sony/etc/rdfs.news700   0    1440   serv1:0 \
                                         clnt2:0
```

[Note]

Comment out by inserting the # comment mark at the head of the line or simply erase the entry lines that are not needed in file the */etc/rdtab*. When file the */etc/rdtab* is changed while the remote disk daemon */etc/rdd* is running, it is necessary to terminate the running */etc/rdd* with the kill command and startup */etc/rdd* again.

2. Change the entries of the file */etc/rc.net*.

Since the portions which startup the remote disk daemon */etc/rdd* in the file */etc/rc.net* are commented out, erase the # comment mark to enable startup.

```
# if [ -f /etc/rdd -a -f /etc/rdtab ]; then
#         /etc/rdd; echo -n 'rdd'                    >/dev/console
# fi
```

↓

```
if [ -f /etc/rdd -a -f /etc/rdtab ]; then
        /etc/rdd; echo -n 'rdd'                    >/dev/console
fi
```

3.12.1.10 Creating Special File

1. Create the special file */dev/ether0* as the */etc/rarpd* interface.

```
# cd /dev
# sh MAKEDEV ether0
```

2. When the Client's ROM monitor does not support the tftpboot, construct the same number of remote disks *rd* as the Client types to be supported.

Create *rd0* for *clnt2*.

```
# cd /dev
# sh MAKEDEV rd0
```

3.12.1.11 Starting Up Daemons

1. Reboot the Server to start up the daemons which supports the diskless workstation.

```
# fastboot
     :
login :
```

2. After the Server is rebooted, login as a superuser (root) again and confirm */etc/rarpd* and */usr/etc/rpc.bootparamd* are running with the **ps** command. When the Server starts up */etc/timed* as master, make sure that */etc/timed* is running with the –M option. Furthermore, when the Client's ROM monitor does not support tftp boot, make sure */etc/rdd* is running as well.

```
# ps ax | grep etc
root    51   0.0  0.9  132  120  ?   I   0:16  /etc/timed -M
root   178   0.0  1.0  156  136  ?   S   0:01  /etc/inetd
root   132   0.0  1.1  180  152  ?   S   0:00  /etc/rdd
root   128   0.0  1.2  176  164  ?   I   0:00  /usr/etc/rpc.bootparamd
root   130   0.0  0.8  124  112  ?   I   0:00  /etc/rarpd
    :
```

When these daemons are not running properly, the Server has not been set up correctly. Redo the Server setup again.

3.12.2 Setting Up Client

After the Server setup is complete and the Server is rebooted, create the Client's file system. The Client setups are entirely done on the Server.

3.12.2.1 Creating Client's File System

Copy the necessary Client's file systems to the directory for the Client's file system specified in the file */etc/bootparams.*

This operation differs depending on the CPU family relationship of the Server and Client.

When the CPU family of the Server and Client is homogeneous:
When the Server and the Client are both RISC NEWS or CISC NEWS, they can share object programs. In these situations, the file systems for the Client are copied from the Server's file systems.

The file systems to be copied are as follows.

- root file system
- */var* file system

The following is an explanitory example for the Server *serv1* and Client *clnt1.*

1. Copy the root file system.

   Copy from the Server's root file system / to the directory for the Client's root file system with the **dump** command.

   Here, copy to the directory */export/nfsroot/clnt1* for the Client *clnt1* root file system .

```
# cd /export/nfsroot/clnt1
# dump 0f - / | restore rf -
```

2. Copy the */var* file system.

   Copy the Server's */var* file system to the directory in the Client's root file system.

   Here, copy to the Client *clnt1* root file system */export/nfsroot/clnt1.*

```
# cd /var
# tar cf - ./ | (cd /export/nfsroot/clnt1/var ; tar xpvf - )
```

When the CPU family of the Server and Client are heterogeneous:

When the Server is RISC NEWS and the Client is CISC NEWS, the Server and Client cannot share the same object programs. In this case, the Client's file system must be read in from the NEWS-OS Release 4.0C Installation Kit.

File systems to be read in are as follows.

- root file system
- */usr* file system

Here is an explanatory example of Server *serv1* and Client *clnt2.*

1. Read in the */usr* file system for CISC NEWS from the installation kit program.

   Here, use the **/usr/sony/etc/copyrd** command to read Client's root file system under */export/CISC.*

```
# mkdir /export/CISC
# /usr/sony/etc/copyrd -u /export/CISC
```

   The CISC NEWS Clients use this */export/CISC/usr* with NFS mount.

2. Change the file */etc/exports*. Add the following line to the file */etc/exports* to export the CISC NEWS */usr* file system.

```
/export/CISC/usr                    -ro
```

3. To export the directory added to this entry, execute the **exportfs** command. First unexport all of the directories currently exported, and then, export all of the entries recorded in the file */etc/exports* as follows:

```
# exportfs -a -u
# exportfs -a
```

[Note]
The Client uses the */usr* file system with NFS mounting. For this reason, even when several CISC NEWS Clients are supported, only one reading of the */usr* file system from the NEWS-OS Release 4.0C Istallation Kit is sufficient.

4. Read in use **/usr/sony/etc/copyrd** command to read in the root file system for CISC NEWS to the directory for Client's root file system. The */var* file system is also read in.

Here, read in to the *clnt2* root file system */export/nfsroot/clnt2*.

```
# /usr/sony/etc/copyrd -r /export/nfsroot/clnt2
```

[Note]
It is necessary to set up a root file system for each Client. When several CISC NEWS Clients are to be supported, it is necessary to either read in from the NEWS-OS Release 4.0C Installation Kit with the **/usr/sony/etc/etc/copyrd** command or copy another Client's root file system with the **tar** command for each Client.

5. Create special files.

Since special files will not be created under the Client's directory */dev* when the root file system is read in with the **/usr/sony/etc/copyrd** command, the necessary special files must be created.

Client	Necessary Special Files
NWS-700 Series	std fb fb0 pty0 pty1 keyboard mouse
Others	std fb fb0 pty0 prt1 keyboard mouse rs0 sb fd0 lp0

Create special files for the Client *clnt2* .

```
# cd /export/nfsroot/clnt2/dev
# sh MAKEDEV std pty{0,1} fb fb0 keyboard mouse
```

3.12.2.2 Copying Kernel Program

1. Copy the kernel program to the Client root file system.

   Copy *iopboot* for the NWS-800 Series. The kernel programs and *iopboot* for diskless workstation are installed when the item diskless is selected at the time of installation.

Client	Kernel	iopboot
NWS-700 Series	/sys/OBJ.news700/vmunix	–
NWS-800 Series	/sys/OBJ.news800/nfsvmunix	/sys/OBJ.news800/iopboot
NWS-1500 Series	/sys/OBJ.news1400/nfsvmunix	–
NWS-1700 Series	/syst/OBJ.news1700/nfsvmunix	–
NWS-3400 Series	/sys/OBJ.news3400/nfsvmunix	–
NWS-3700 Series	/sys/OBJ.news3700/nfsvmunix	–

   [Note]
   When these kernel programs are not present, an additional installation should be done.

   For the Client *clnt1*, copy the kernel program as follows

```
# cd /export/nfsroot/clnt1
# cp -p /sys/OBJ.news3700/nfsvmunix vmunix
```

   For the Client *clnt2*, the copy the program as follows

```
# cd /export/nfsroot/clnt2
# cp -p /sys/OBJ.news700/vmunix vmunix
```

2. Depending on the copy source, unnecessary files such as *iopboot* and *mrx* may exist. The *boot* is also not needed. Erase these unnecessary files.

```
# rm -f {iopboot,mrx,boot}
```

3.12.2.3 Copying Boot Program

/etc/tftpd carries out the tftp service after changing the root directory (chroot), which is specified with –s option at time of startup on the Server.

1. Create a directory for *tftp*.
   Place each Client's boot program and boot kernel program in the tftp directory. This kernel program is created by hardlinking to the kernel in each root file system. For this reason, the directory for the Client's root file system and the tftp directory must exist within the same file system.

   In this example, since both *clnt1* and *clnt2* have a root file system in */export* file system, make */export/tftpboot* to be the actual file of the tftp directory and make a symbolic link from */tftpboot* to */export/tftpboot*.

   ```
   # mkdir /export/tftpboot
   # ln -s /export/tftpboot /tftpboot
   ```

2. */etc/tftpd* operates in the */export/tftpboot* directory as the root directory. To load the programs under */tftpboot*, it is necessary to make a symbolic link from */export/tftpboot/tftpboot* to */export/tftpboot*.

   ```
   # cd /export/tftpboot
   # ln -s . tftpboot
   ```

3. When the Client's ROM monitor supports tftp boot, copy the tftp protocol boot program.
   The actual boot program is */usr/mdec.mips/tftpboot*. Copy this boot program under the tftp protocol boot program name specified by the **bf=** entry in the file */etc/bootpd*.

   For Client *clnt1*, copy the boot program in the following way.

   ```
   # cd /export/tftpboot
   # cp -p /usr/mdec.mips/tftpboot tftpboot.mips
   ```

4. Create a hardlink of a kernel program for the boot.

   ```
   # ln vmunix_path iiii.mmmm
   ```

   where *vmunix_path* is the actual path of Client's vmunix, *iiii* is the Client's Internet address, (in hexadecimal, a ~ f small characters), and *mmmm* is the machine type.

iii.mmmm, placed under the directory */tftpboot* is the kernel implemented from the boot program and *vmunix* placed in the Client's root file system is the kernel which is referred to by the **ps** command after the system has started. It is recommended that the kernel programs should be hardlinked rather than be copied to avoid any inconsistency.

When the Client is NWS-800 Series, also hardlink *iopboot* for the boot in the following way.

```
# ln  iopboot_path  iiii.mmmmiop
```

where *iopboot_path* is the actual path of Client's iopboot, *iiii* is the Client's Internet address (in hexadecimal), and *mmmm* is the machine type.

For the Client *clnt1*, hardlink in the following way.

```
# ln  /export/nfsroot/clnt1/vmunix  6400000b.news3700
```

For the Client *clnt2*, hardlink in the following way.

```
# ln  /export/nfsroot/clnt2/vmunix  6400000c.news700
```

[Note]
From now on, when changing the Client's kernel, write over with the **cp** command and not with the **mv** command.

```
# cd  /export/nfsroot/clnt1
# cp  -p  vmunix  vmunix.bak
# cp  -p  vmunix.new  vmunix
```

You can not place a directory for the Client's root file system in another file system by hard linking since */tftpboot* is already symbolic linked to */export/tftpboot*. In this case, copy the kernel under */tftpboot* in the form of *iiii.mmmm* whenever changing the kernel.

5. When the Client is CISC NEWS, set path for architecture dependent commands.
   CISC NEWS has two types of architectures : mc68020 and mc68030.

Client	Architecture
NWS-700 Series	mc68020
NWS-800 Series	
Another CISC NEWS	mc68030

The these architecture dependent commands are either in directory mc68020 or mc68030 under the Client's directory */usr/arch.* Make a symbolic link from the Client's */sbin/arch* to each directory according to the Client's architecture.

For the Client *clnt2* make a symbolic link to Client's */usr/arch/mc68020* since the Client *clnt2* has mc68020 architecture.

```
# cd /export/nfsroot/clnt2/sbin
# rm -f arch
# ln -s ../usr/arch/mc68020 arch
```

6. The following are other setups occasionally necessary in the Client.

- Timezone setup
- Keymap change

Concerning these, refer to the section "Files created with full-installation" in the chapter "NEWS-OS Full Installation (from Tape)" in the NEWS-OS Release 4.0 Installation Kit Instruction Manual".

3.12.3 Setting Up Client's File

At this point, the Client's file system has been installed and the necessary directories and files have been created/copied under the Client's file system. Now change the necessary files in the Client's file system to enable a normal Client boot.

- Confirm the Client's */etc/hosts* file
- Change the Client's */etc/rc.custom* file
- Change the Client's */etc/fstab* file
- Change the Client's */etc/inetd.conf* file
- Change the Client's */etc/rc.net* file
- Erase the Client's */etc/exports* file
- Erase the Client's */etc/rdtab* file
- Erase the Client's */etc/ethers* file
- Erase the Client's */etc/bootptab* file
- Erase the Client's */etc/bootparams* file

These operations are all carried out on the Server. Be careful not to change files for the Server. In the following example, the path for the diskless file is represented as */DISKLESS/...* in order to differentiate them from the Server files.

Example)
Client's file */etc/rc.custom* —> /DISKLESS/etc/rc.custom

Here is an explanatory example mostly of the Client *clnt1*.

3.12.3.1 Confirming Client's */etc/hosts* file

Copy Server's */etc/hosts* file to the Client's file system. As in the Client *clnt1* example, when the CPU family of the Client and Server are homogeneous, this operation in unnecessary since the Server's root file system has been copied. Confirm whether or not the Server and Client information has been entered correctly.

Here is an example for a Client *clnt2* which has different CPU family from the server.

```
# cp  -p  /etc/hosts  /export/nfsroot/clnt2/etc
# mkhosts  /export/nfsroot/clnt2/etc/hosts
```

3.12.3.2 Changing Client's */etc/rc.custom* file

Enter information peculiar to the Client in */DISKLESS/etc/rc.custom.*

1. Change the HOSTNAME to the Client's host name and, BROADCAST and NETMASK to the same parameters described in the Server's.

   Client *clnt1* file */DISKLESS/etc/rc.custom* is actually the file */export/nfsroot/clnt1/etc/rc.custom* on the Server.

```
HOSTNAME=serv1
        :
BROADCAST=100.255.255.255
        :
NETMASK=255.0.0.0
```

```
HOSTNAME=clnt1
        :
BROADCAST=100.255.255.255
        :
NETMASK=255.0.0.0
```

[Note]

When the CPU family of the Client and Server is the same, only the HOSTNAME must be changed since the Server's root file system has already been copied.

2. Make a setup which enables */etc/timed* to startup as slave on the Client. In order for */etc/timed* to start up as slave, enter "slave" behind the entry **TIMED=** of Client's */DISKLESS/etc/rc.custom* file. In fact, */etc/timed* is startedup from the script file */etc/rc*.net.

   Change the entry of file */export/nfsroot/clnt1/etc/rc.custom* as follows:

```
TIMED=master
        ↓
TIMED=slave
```

3. Setup network environment.

   When "off" is written behind the entry **NET=** of the Client */DISKLESS/etc/rc.custom* file, the network is unusable. To use the network, erase the word "off" or overwrite it with other characters.

   Change the entry of the file */export/nfsroot/clnt1/etc/rc.custom* as follows:

```
NET=off
        ↓
NET=
```

3.12.3.3 Changing Client's */etc/fstab* file

In order to use the file systems with NFS mounting, described in the file */etc/bootparams* (which is entered in the Server file setup) change the Client */DISKLESS/etc/fstab* file.

When the CPU family of the Server and Client is homogeneous:

Change the entry of the file */export/nfsroot/clnt1/etc/fstab* as follows:

```
/dev/sd00a    /          4.3    rw          1    1
/dev/sd00d    /tmp       4.3    rw,delay    1    2
/dev/sd00e    /var       4.3    rw          1    3
/dev/sd00f    /export    4.3    rw          1    4
/dev/sd00h    /usr       4.3    rw          1    5
```

↓

```
serv1: /export/nfsroot/clnt1    /       nfs rw          0    0
serv1: /usr                     /usr    nfs ro, noauto  0    0
```

When the CPU family of the Server and Client are heterogeneous:

Change the entry of the file */export/nfsroot/clnt2/etc/fstab* as follows:

```
/dev/sd00a    /          4.3    rw          1    1
/dev/sd00d    /tmp       4.3    rw,delay    1    2
/dev/sd00e    /var       4.3    rw          1    3
/dev/sd00f    /export    4.3    rw          1    4
/dev/sd00h    /usr       4.3    rw          1    5
```

↓

```
serv1: /export/nfsroot/clnt1    /       nfs rw          0    0
serv1: /export/CISC/usr         /usr    nfs ro,noauto   0    0
```

[Note]
Do not leave any blank lines in the file */DISKLESS/etc/fstab*.

3.12.3.4 Changing Client's */etc/inetd.conf* file

Confirm whether or not the lines *tftpd* and *bootpd* in the Client's */DISKLESS/etc/inetd.conf* file are commented out. If they are not commented out, place a # at the head of each line.

Change the entry of the file */export/nfsroot/clnt1/etc/inetd.conf* as follows:

```
        :
tftp    dgram udp wait root   /etc/tftpd    tftpd -s /tftpboot
bootps  dgram udp wait root   /etc/bootpd   bootpd
        :
```

```
        :
#tftp   dgram udp wait root   /etc/tftpd    tftpd -s /tftpboot
#bootps dgram udp wit root    /etc/bootpd   bootpd
        :
```

3.12.3.5 Changing Client's */etc/rc.net* file

1. Comment out the portions which start up */etc/rarpd, /usr/etc/rpc.bootparamd, /usr/etc/rdd,* and */etc/nfsd* in the Client's */DISKLESS/etc/rc.net* file by placing # at the head of each line.

   Change the entry of the file */export/nfsroot/clnt1/etc/rc.net* as follows:

```
if [ -f /etc/nfsd -a -f /etc/exports ]; then
        /etc/nfsd 4 & echo -n 'nfsd'                    >/dev/console
fi
        :
if [ -f /usr/etc/rpc.bootparamd ]; then
        /usr/etc/rpc.bootparamd & echo -n 'bootparamd'  >/dev/console
fi
        :
if [ -f /etc/rarpd ]; then
        /etc/rarpd; echo -n 'rarpd'                     >/dev/console
fi
        :
if [ -f /etc/rdd -a -f /etc/rdtab ]; then
        /etc/rdd; echo -n 'rdd'                         >/dev/console
fi
```

```
# if [ -f /etc/nfsd -a -f /etc/exports ]; then
#       /etc/nfsd 4 & echo -n 'nfsd'                    >/dev/console
# fi
        :
# if [ -f /usr/etc/rpc.bootparamd ]; then
#       /usr/etc/rpc.bootparamd & echo -n 'bootparamd'  >/dev/console
#fi
        :
# if [ -f /etc/rarpd ]; then
#       /etc/rarpd; echo -n 'rarpd'                     >/dev/console
# fi
        :
# if [ -f /etc/rdd -a -f /etc/rdtab ]; then
#       /etc/rdd; echo -n 'rdd'                         >/dev/console
# fi
```

3.12.3.6 Erasing Unnecessary Client's Files

The following files are unnecessary for the Client. Erase them from the Client's file system.

```
# cd /export/nfsroot/clnt1/etc
# rm exports
# rm rdtab
# rm ethers
# rm bootptab
# rm bootparams
```

3.12.3.7 Changing Other Client's Files

The following file setups may be necessary depending on the Client system.

- Client's */etc/ttys* file
- Client's */etc/sysinfo* file

Concernig these, refer to the section "File Generated with Full-Installation" of the chapter "NEWS-OS Full Installation (from Tape)" in "the NEWS-OS Release 4.0 Installation Kit Instruction Manual.

3.13 Setups for Remote Disk

An example of how to setup a root file system and swap area to use the remote disk is given here using the following workstations as Clients.

Workstation	Hardware Address
NWS-3410	8:0:46:0:14:c1
NWS-721	8:0:46:0:14:c2

The following workstation will be the Server.

Workstation	Hardware Address
NWS -3870	8:0:46:0:11:6d

When the Client is NWS-3410 and the Server is NWS-3870, both are RISC NEWS and therefore, fall under an example of a homogeneous CPU family. When the Client is NWS-721 and, the Server is NWS-3870, the Client is CISC NEWS and the Server is RISC NEWS and, therefore, fall under an example of an heterogeneous CPU families.

3.13.1 Setting Up Server Files

Login as a super user (root), to do the setups described in this section.

The following are the files to need be changed

/etc/hosts
/etc/rc.custom
/etc/ethers
/etc/rc.net
/etc/rdtab

3.13.1.1 Changing */etc/hosts* file

Enter each host Internet address, host name, and aliases in the host name database file */etc/hosts* (refer to *hosts* (5)). When setting up for a diskless workstation, it is necessary to enter the Internet addresses of each Server/Client workstation.

1. Decide the host name of each workstation.

   In this section, the following host names and aliases (alias is optional) are used for the Server and Client workstations.

	Workstation	Host Name	Alias
Server	NWS-3870	serv1	nws3870
Client	NWS-3410	clnt3	nws3410
	NWS-721	clnt4	nws721

2. Decide the Internet addresses for each Server and Client workstations.

   In this section, the following Internet addresses are used for each Server and Client workstations.

Host Name	Internet Address
serv2	100.0.0.1
clnt3	100.0.0.13
clnt4	100.0.0.14

3. Changing */etc/hosts* file.

   An example of */etc/hosts* file:

```
127.1           localhost
100.0.0.1       serv1           nws3870
100.0.0.13      clnt3           nws3410
100.0.0.14      clnt4           nws721
```

4. After changing file */etc/hosts,* add new hosts to the system. (refer to *mkhosts* (8))

```
# mkhosts   /etc/hosts
```

[Note]

For the NIS (Network information Service) Client, the file */etc/hosts* must have at least localhost and your own entry since it is referred to at the time of system startup.

Add them in the NIS Server when using the NIS.

3.13.1.2 Changing */etc/rc.custom* file

Enter the basic information peculiar to a workstation such as host names and domain names in the file */etc/rc.custom*. When the Server's HOSTNAME, BROADCAST, and NETMASK are not yet setup, decide them and change the entries in the file */etc/rc.custom*.

1. Setup the following parameters of a Server workstation.

   - HOSTNAME
   - BROADCAST
   - NETMASK

   These values differ depending on the system being used (refer to *ifconfig* (8) in On-Line Manual concerning BROADCAST and NETMASK).

   Here is an example which sets up HOSTNAME as the Server's hostname *serv1*, BROADCAST as *100.255.255.255*, and NETMASK as *255.0.0.0*.

   Change the entry of the file */etc/rc.custom* as follows:

```
HOSTNAME=myname.my.domain
        :
BROADCAST=my-broadcast
        :
NETMASK=my-netmask
```

↓

```
HOSTNAME=serv1
        :
BROADCAST=100.255.255.255
        :
NETMASK=255.0.0.0
```

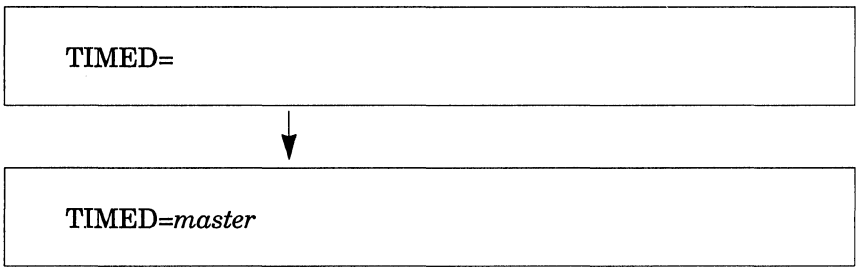
2. Set up */etc/timed* to run as master.

Since the Client always starts up */etc/timed* as slave, the master time server is necessary in the network where the Clients are connected (refer to *timed* (8)). The master time server can be found out by executing the **timedc** command from any workstation in the network, where */etc/timed* is running.

```
# timedc
timedc> msite
master timedaemon runs on machine
```

If the master time server does not exist in a network where the Clients are connected, it is necessary to startup the master time server on the Server. To startup **/etc/timed** as master, enter "master" after the entry **TIMED=** in the file */etc/rc.custom.* Actually, **/etc/timed** is started up from the script file */etc/rc.net.*

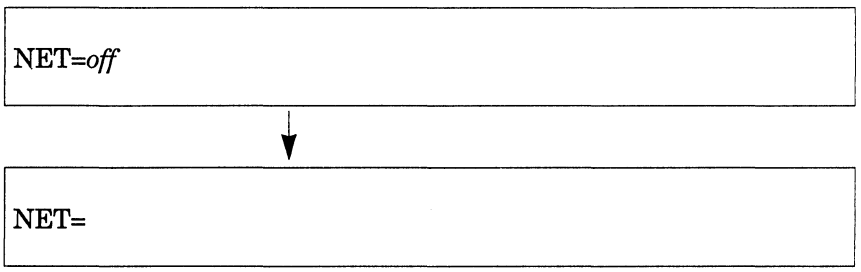
Change the entry of the file */etc/rc.custom* as follows:



3. Setup network environment.

When "off" is written after the entry **NET=** in the file */etc/rc.custom,* network is unusable. In such a case, erase the word "off" or overwrite it with another characters to enable the network.

Change the entry of the file */etc/rc.custom* as follows:



3.13.1.3 Changing */etc/ethers* file

In the file */etc/ethers,* enter hardware addresses and host names of the workstations on Ethernet. This information is referred to by the Reverse Address Resolution Protocol Daemon */etc/rarpd.*

When setting up a diskless workstation, */etc/rarpd* must be running in the network. If */etc/rarpd* is running on another workstation, it is necessary to add the Server and Client information to the file */etc/ethers* on that workstation. If no */etc/rarpd* is running in the network, it is necessary to startup */etc/rarpd* on the Server. In such a case, enter the Server and Client information in the Server's */etc/ethers.*

[Note]
If several */etc/rarpd* are running in the network, make sure there is no contradiction in */etc/ethers* files of the workstations which */etc/rarpd* is running. Contradiction in */etc/ethers* files will cause Client's system startup failure.

The hardware address is the information peculiar to each NEWS workstation written in the system's ROM. This is not the same as the Internet address which is given at the time of network settings. This value is necessary when setting up other files.

1. Confirm the Server and Client hardware addresses.
   There are two ways of finding out the hardware address.

   The ROM monitor screen when power is switched on:

   An example of NWS-3870:

   > **SONY NET WORK STATION *MC68030 Monitor Release 1.7***
   > **Model *NWS-3870,* Machine ID *#xxxx,* Ethernet address**
   > ***08:00:46:00:11:6d***
   > **NEWS>**

   The underlined portion is the hardware adderess of this workstation. From this screen, you can find out the hardware addresses of diskless workstations or workstations whose power are not on.

The screen at the time of NEWS-OS startup:

```
NEWS> bo
      :
en0: hardware address 08:00:46:00:11:6d
      :
```

The underlined portion is the hardware address of this workstation.
This message can be confirmed after system startup with the **/etc/dmesg** command.

```
% /etc/dmesg | grep  hardware
en0: hardware address 08:00:46:00:11:6d
```

In this way, hardware address of the workstations whose systems are up can be checked.

[Note]
Depending on the workstations, the hardware address will be displayed either 08:00:46:00:11:6d or 8:0:46:0:11:6d. Either format is acceptable.

2. Changing */etc/ethers* file.

An example */etc/ethers* file:

```
# Hardware ethernet -address        hostname
00:00:00:00:00:00                   myname
```

↓

```
08:00:46:00:11:6d       serv1
08:00:46:00:14:c1       clnt3
08:00:46:00:14:c2       clnt4
```

[Note]
Do not leave any blank lines in the file */etc/ethers*.

3.13.1.4 Changing */etc/rdtab* file

The file */etc/rdtab* (Remote Disk Table) is the key to the Server disk allocation for the diskless Client workstations. The corresponding relationship between the Client's remote disk and the files on the Server and its disk space size are defined in this file.

There are several ways of allocating Server's disk space to Clients.

- Specifying the diskless workstation file system by its file name.
  Since it is unnecessary to change the existent partition sizes, setting up a Server by this method is fastest and easiest. However, should the Server crash while the Client is in operation, there is a possibility that the Client's file will can become corrupted.

- Spliting the existant Server partition so that the Client's file system and the Server's file system are separately assigned.

  That is, resize the Server's partition size using the RAW disk device (such as */dev/rsd00f)* and assign the rest of the disk space to the Client. With this method, should the Server crash during Client's operation, there is little risk of damage to the Client's files.

- Allocating a Client's file system under the RAW device where the Client workstations "own" a single partition.
  The setup procedure is similar to the procedure of spliting the existant partitions to the Server and Client, but with this method disk space is not assigned to the Server. Should the Server crash while the Client is in operation, there is little possibility that the Client's files will be destroyed. Use this method if possible.

- Allocating a Client's file system under a RAW device where the Client workstations own an entire expansion disk.

Whichever method described above is used, it is necessary to enter the entry in the file */etc/rdtab* when allocating disk space to the Client. The entry of the file */etc/rdtab* is as follows (see *rdtab* (8)). When settign up a Client's file system, it is necessary to enter a Server itself as a Client beforehand.

[Note]
When changing the file */etc/rdtab* while remote disk daemon */etc/rdd* is running, kill the running */etc/rdd* daemon with the **kill** command and startup */etc/rdd* daemon again.

The following four entries are described in the file */etc/rdtab* in the format shown below. A "\" at the end of a line means that it is continued to the following line.

file offset size client; monitor . . .

file Specify the full path name of the file to be read or written, when accessed from a remote disk. Either RAW device file (*/dev/rsd01c* etc.) or general file in the file system can be specified. However, should the Server crash when using a general file, the files specified here may possibly be destroyed. Please be cautious.

[Note]
Do not execute the **fsck** command on the specified files while the Client is in operation.

offset Specify the offset in block units (1 block = 512 bytes) from head of the file to the portion which is actually used in the file specified in the *file* entry. This value is used when using the RAW device (*/dev/rsd00f* etc.) file system. When using a file system other than the RAW device, set the field at 0.

size Specify the size of the space actually used by the diskless Client wordstation in block units (1 block = 512 bytes). Normally, specify 15884 blocks when it is used as a root file system and more than 15884 blocks when it is used as the Client's */var* file system. Make sure the size in the swap area is, at least, larger than the main memory size (two to four times if possible).

[Note]
Since system operational difficulties arise when there are fewer than 33440 blocks, specify more than 33440 blocks in *size*.

client:minor Specify the Client's host name and the minor device number of the Client's remote disk in the form of *client : minor*. The Server's hostname and the Client's hostnames are the same as those recorded in the file */etc/hosts*. The actual disk partition can be allocated one of the eight partitions (from a to h).

Following is the Client's partition name and the corresponding Server's minor number.

Device name	Minor Number
rd0a	0
rd0b	1
rd0c	2
rd0d	3
rd0e	4
rd0f	5
rd0g	6
rdoh	7
:	
rd7a	56
rd7b	57
rd7c	58
rd7d	59
rd7e	60
rd7f	61
rd7g	62
rd7h	63

The NEWS-OS driver supports a maximum of eight remote disks (*rd0 - rd7*). Be aware that the number of supporting remote disks differs depending on the machine type of the workstation. Any Client can be assigned to each partitian (a – h) and every coupling of Client and Server can be specified by minor numbers from 0 to 63.

[Note]
Create the remote disk in ascending order from rd0.

Client's file system example 1:

When constructing a Client's file system in the Server file system:

1. Decide the following file (directory) names and sizes of Client's file system.

- Root File System
- Swap File
- */var* File System

Set up the file names and sizes for the Client *clnt3* file system as follows:

Root File System	Directory Name	*/export/diskless/clnt3a*
	Size	15884 blocks
Swap File	File Name	*/export/diskless/clnt3b*
	Size	66880 blocks (32 Mbytes)
/var File System	Directory Name	*/export/diskless/clnt3e*
	Size	55936 blocks

Set up for the file name and size the Client *clnt4* file system as follows:

Root File System	Directory Name	*/export/diskless/clnt4a*
	Size	15884 blocks
Swap File	File Name	*/export/diskless/clnt4b*
	Size	33440 blocks (16 Mbytes)
/var File System	Directory Name	*/export/diskless/clnt4e*
	Size	16834 blocks

2. Change the entry of the file */etc/rdtab*.

An example of the file */etc/rdtab* :

```
#
# rd0
#
/export/diskless/clnt3a     0       15884     serv1:0 \
                                              clnt3:0
/export/diskless/clnt3b     0       66880     serv1:1 \
                                              clnt3:1
/export/diskless/clnt3e     0       55936     serv1:4 \
                                              clnt3:4
#
# rd1
#
/export/diskless/clnt4a     0       15884     serv1:0 \
                                              clnt4:0
/export/diskless/clnt4b     0       33440     serv1:1 \
                                              clnt4:1
/export/diskless/clnt4e     0       16384     serv1:4 \
                                              clnt4:4
```

[Note]
Do not leave any blank lines in the file */etc/rdtab*.
Also, comment out all the unnecessary entry lines by erasing or placing a # comment mark at the head of the line.

3. Create a Client's root file system named in the file */etc/rdtab*.

```
# mkdir /export/diskless
# touch /export/diskless/clnt3a
# touch /export/diskless/clnt4a
```

4. Create a Client's swap file named in the file */etc/rdtab* with the **dd** command.

Create swap files of 66880 blocks (32 Mbytes) for Client *clnt3* and 33440 blocks (16 Mbytes) for Client *clnt4*. Specify the block size being set up minus one at *seek=* option of the **dd** command.

```
# date | dd of=/export/diskless/clnt3b seek=66879 conv=sync
# date | dd of=/export/diskless/clnt4b seek=33439 conv=sync
```

5. Create a Client's */var* file under the name recorded in the file */etc/rdtab*.

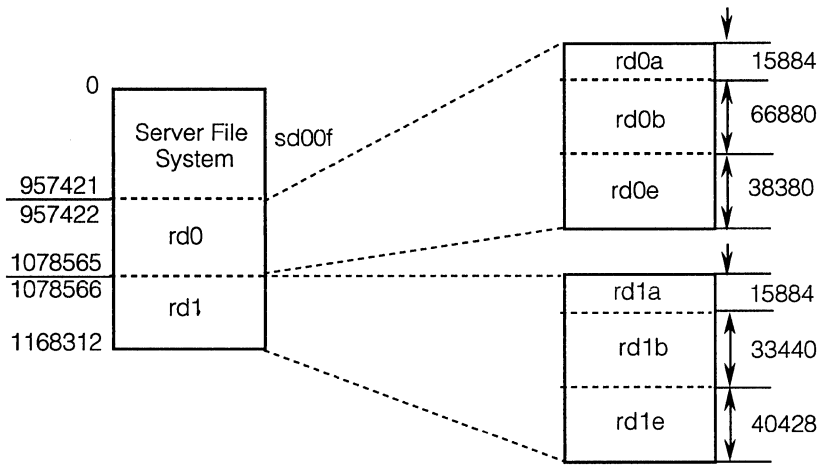
```
# touch /export/diskless/clnt3e
# touch /export/diskless/clnt4e
```

Client's file system example 2:
Allocating the Client's file system on a shared partition.

In this example, a Server and Client both share one partitian (*/dev/sd00f*) on the 1280 Mbyte internal hard disk.
The Server's portion is resized and made smaller, then the remainder of the disk space on RAW device is allocated to the Client. This method creates the Client's file system under the RAW disk device for the partition while the Server continues to exist under the block disk device. The Server file systems and the Client's file systems are completely independent from each other so there is no chance that the Client's files system will sustain damage if the Server should crash.

[Note]
Partitions under use in the block device cannot be written as the RAW device. Because of this, when dividing one partition between the Server block device and the Client RAW device, you must reconfigure the kernel and enable RAW device access for read /write operations on the block device. For details concerning necessary changes, see *sd* (4) in On-Line Manual.

Here, set up the Client *clnt3* root file system size at 15884 blocks, the swap file size at 66880 blocks (32 Mbytes), and the */var* file system size at 38380 blocks. Set up the Client *clnt4* root file system size at 15884 blocks, the swap area size at 33440 blocks (16 Mbytes), and the */var* file system size at 40428 blocks. The remaining 957422 blocks are used by the Server, as shown in the figure below.



1. Change the entry in the file */etc/rdtab.*

An example of the file */etc/rdtab*

```
#
# rd0
#
/dev/rsd00f          957422      15884       serv1:0 \
                                             clnt3:0
/dev/rsd00f          973306      66880       serv1:1 \
                                             clnt3:1
/dev/rsd00f          1040186     38380       serv1:4 \
                                             clnt3:4
#
# rd1
#
/dev/rsd00f          1078566     15884       serv1:0 \
                                             clnt4:0
/dev/rsd00f          1094450     33440       serv1:1 \
                                             clnt4:1
/dev/rsd00f          1127890     40428       serv1:4 \
                                             clnt4:4
```

[Note]

Do not leave any blank lines in the file */etc/rdtab.*

Also, comment out all unnecessary entries by erasing or placing a # comment mark at the head of the line.

2. If necessary, use the **tar** command to create a backup of the contents of file system */export,* then umount */export.* The following commands show one way to use the **tar** command with the internal tape device.

```
# cd   /export
# tar  cvf   /dev/rst00   ./
# cd   /
# umount   /export
```

3. Resize the file system */export* (*/dev/sd00f*) to reflect the decreased disk space available to the Server.

   In this example, set size of */dev/sd00f* as 957422 blocks. The disk type of the hard disk of a standard installation is recorded as hdsd*xx_yy* described in the file */dev/disktab.* In this case, it is *hdsd00_1280.*

```
# newfs   -s   957422   /dev/rsd00f   hdsd00_1280
```

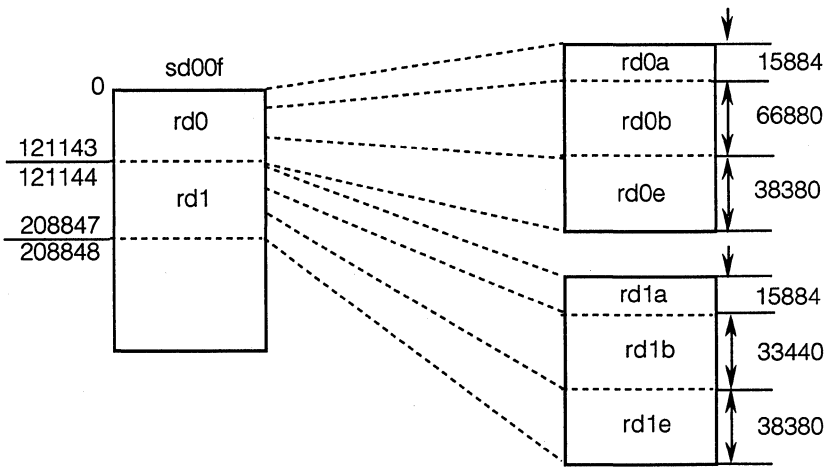
4. After changing the partition size, mount the file system */export* again, read the files from the tape with the **tar** command and copy it to */export.*

```
# mount   /export
# cd   /export
# tar  xvf   /dev/rst00   ./
```

Client's file system example 3:

When the Client owns a single partition */dev/sd00f* :

In this example, allocate the 1280 Mbyte of the Server */dev/sd00f* to the Client's root file system, the swap area, and the */var* file system. Only the Client's use this partition and do not share it with the Server. It is also possible to allocate all of the unused disk spaces to the Client.



1. In this expample, use the example value for the partition sizes shown in the figure and change the file */etc/rdtab* as follows.

   An example of the file */etc/rdtab* :

```
# file          offset    size      client:minor ...
#
# rd0
#
/dev/rsd00f     0         15884     serv1:0 \
                                    clnt3:0
/dev/rsd00f     15884     66880     serv1:1 \
                                    clnt3:1
/dev/rsd00f     82764     38380     serv1:4 \
                                    clnt3:4
#
# rd1
#
/dev/rsd00f     121144    15884     serv1:8 \
                                    clnt4:0
/dev/rsd00f     137028    33440     serv1:9 \
                                    clnt4:1
/dev/rsd00f     170468    55936     serv1:12 \
                                    clnt4:4
```

[Note]

Do not leave any blank lines in the file */etc/rdtab*.

Also, comment out all the unnecessary entries by erasing or plecing a # comment mark at the head of the line.

2. To make a Server's partition */dev/sd00f* free for Client's file systems. Erase the description for */dev/sd00f* in the Server's */etc/fstab* file.

```
/dev/sd00a      /         4.3 rw          1    1
/dev/sd00d      /tmp      4.3 rw,delay    1    2
/dev/sd00e      /var      4.3 rw          1    3
/dev/sd00f      /export   4.3 rw          1    4
/dev/sd00h      /usr      4.3 rw          1    5
```

```
/dev/sd00a      /        4.3  rw        1  1
/dev/sd00d      /tmp     4.3  rw,delay  1  2
/dev/sd00e      /var     4.3  rw        1  3
/dev/sd00h      /usr     4.3  rw        1  5
```

[Note]

Do not leave any blank lines in the file */etc/fstab*.

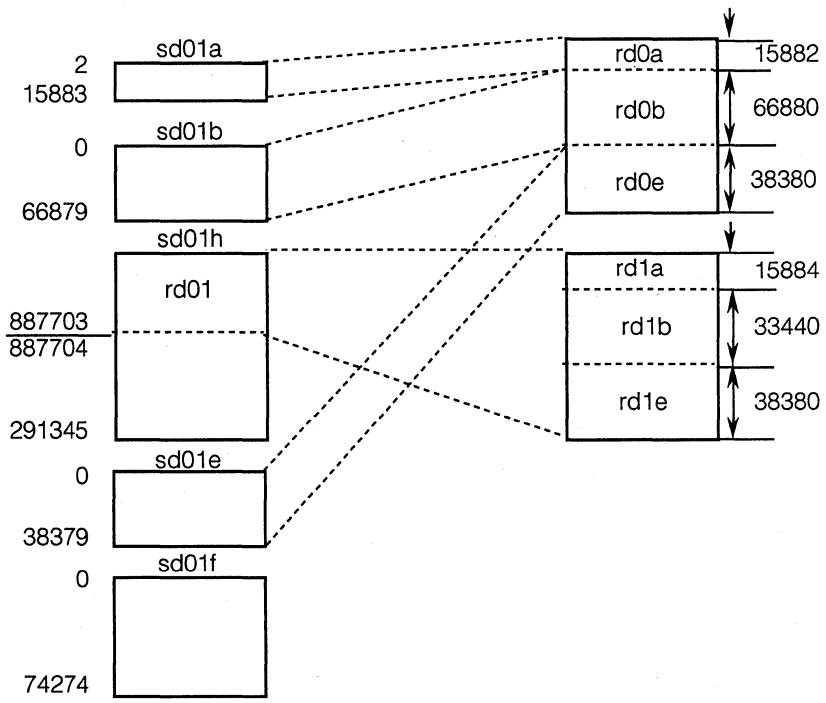
3. If necessary, backup any files on the file system */export* (*/dev/sd00f*) in the following way and umount */export*.

```
# cd   /export
# tar  cvf  /dev/rst00  ./
# cd   /
# umount   /export
```

Client's file system example 4:

When connecting the expansion hard disk to the Server and using a portion or all of it for the Client's file system:

In this example, several Client's file systems on a 286 Mbyte expansion hard disk (disk type hd2861) partition are created.



Partitions *a*, *b*, and *e* of expansion hard disk (NWP-535) are allocated to the Client's *clnt3* (*rd0*), and partitian *h* to the Client *clnt4* (*rd1*). Because partition *f* on the expansion hard disk is not used by the Client, it is available for the Server.

[Note]
The disk label in the NEWS-OS Release 4.0 is written in the first block of the disk. Because of this, when the offset of the remote disk is set up as 0 at the head of the disk, the contents of the disk label will be destroyed when a boot block is copied to the remote disk. To avoid such an accident, set up an offset other than zero when establishing a remote disk at the head of a disk.

1. Change the entry of the file */etc/rdtab* .

An example of the file */etc/rdtab* :

```
#
# rd0
#
/dev/rsd01a     2       15882       serv1:0 \
                                    clnt1:0
/dev/rsd01b     0       66880       serv1:1 \
                                    clnt1:1
/dev/rsd01e     0       38380       serv1:4 \
                                    clnt1:4
#
# rd1
#
/dev/rsd01h     0       15884       serv1:8 \
                                    clnt2:0
/dev/rsd01h     15884   33440       serv1:9 \
                                    clnt2:1
/dev/rsd01h     49324   38380       serv1:12 \
                                    clnt2:4
```

[Note]
Do not leave any blank lines in the file */etc/rdtab*.
Also, comment out all the unnecessary entries by erasing or placing a # comment mark at the head of the line.

2. Add the description for partition *f* on the expansion hard disk into the file */etc/fstab*, create the directory to be mounted, and mount the partition.

An example of */etc/fstab* file:

```
/dev/sd00a      /          4.3  rw          1   1
/dev/sd00d      /tmp       4.3  rw, delay   1   2
/dev/sd00e      /var       4.3  rw          1   3
/dev/sd00f      /export    4.3  rw          1   4
/dev/sd00h      /usr       4.3  rw          1   5
```

↓

```
/dev/sd00a      /          4.3  rw          1   1
/dev/sd00d      /tmp       4.3  rw,delay    1   2
/dev/sd00e      /var       4.3  rw          1   3
/dev/sd00f      /export    4.3  rw          1   4
/dev/sd00h      /usr       4.3  rw          1   5
/dev/sd01f      /mnt001f   4.3  rw          1   9
```

```
# mkdir   /mnt001f
# mount   /mnt001f
```

An alternative method to allocate the entire disk for Client's support is to divide partition *c* on the expansion disk by describing suitable offset values and partition sizes in the file */etc/rdtab*.

3.13.1.5 Changing */etc/rc.net* file

The file */etc/rc.net* is the script file for setting the network environment.

1. Since the portions which startup */etc/rarpd* and */etc/rdd* of file */etc/rc.net* are commented out, erase the comment mark # to enable startup of these daemons. At this time, specify the arguments to execute four to eight of */etc/rdd*.

```
# if [ –f  /etc/rarpd  – a  –f  /etc/ethers ];  then
#          /etc/rarpd; echo  –n  ' rarpd'                    >/dev/console
# fi
# if [ –f  /etc/rdd   – a  –f  /etc/rdtab ];  then
#          /etc/rdd; echo   – n   ' rdd                      >/dev/console
# fi
          :
```

↓

```
if [ -f /etc/rarpd -a -f /etc/ethers ]; then
        /etc/rarpd; echo -n ' rarpd'          >/dev/console
fi
if [ -f /etc/rdd -a -f /etc/rdtab ]; then
        /etc/rdd 4 ; echo -n ' rdd'           >/dev/console
fi
        :
```

3.13.1.6 Creating Special File

1. Create the special file */dev/ether0* as the interface of */erc/rarpd*.

```
# cd /dev
# sh MAKEDEV ether0
```

2. Create a special file to support the Client's remote disk service defined in the file */etc/rdtab*. Create a remote disks *rd* for the number of the Clients to be supported.

   In the following example, create *rd0* for Client *clnt3* and *rd1* for Client *clnt4*.

```
# cd /dev
# sh MAKEDEV rd0 rd1
```

3.13.1.7 Activating Remote Disk Daemons

Reboot the Server to activate the remote disk daemons.

```
# fastboot
     :
login
```

1. After rebooting the Server, login as the super user (root) again and confirm the */etc/rarpd* and */etc/rdd* are running using the **ps** command. When the Server starts up */etc/timed* as master, confirm that */etc/timed* is runnig with the -M option.

```
# ps ax | grep etc
root    51   0.0  0.9  132  120  ?  I  0:16 /etc/timed -M
root   132   0.0  1.1  180  152  ?  S  0:00 /etc/rdd 4
root   130   0.0  0.8  124  112  ?  I  0:00 /etc/rarpd
   :
```

The Server setup is wrong when these daemons are not running correctly. Perform the Server setup again.

3.13.2 Setting Up the Client

Create the Client's file system after the Server setup has finished and the Server has been rebooted. The following examples describe the steps performed on the Server workstation.

3.13.2.1 Creating the Client's File System

Use the **newfs** command to create partitions *a* and *e* to be the same size as the remote disk specified in the file */etc/rdtab*. In the following examples, the file system partitions are set corresponding to the samples given in the previous examples 1 through 4.

When the remote disk size differs from the standard size entered in the file */etc/disktab*, specify the size of each Client's file system with the -s option of the **newfs** command.

[Note]
Be certain that the correct disk type is specified in the **newfs** command. The disk type names and the partition sizes used by the **newfs** command are described in the file */etc/rdtab*.

The disk type of a hard disk installed in a standard installation is entered as *hdsdxx_yy* in the file */dev/disktab*. Be careful of the disk type when creating a file system for remote disk on a hard disk which was installed in a standard installation.

Client's file system example 1:
When creating a Client's file system in the Server file system:

In Client *clnt3*, 15884 blocks has been allocated to the root file system (*/export/diskless/clnt3a*) and 16384 blocks to the */var* file system (*/export/diskless/clnt3e*). Create Client's file systems as follows..

```
# newfs /dev/rrd0a hdsd00_1280
# newfs -s 55936 /dev/rrd0e hdsd00_1280
```

In Client *clnt4*, 15884 blocks has been allocated to the root file system (*/export/diskless/clnt4a*) and 16384 blocks to the */var* file system (*/export/diskless/clnt4e*). Create Client's file systems as follows..

```
# newfs /dev/rrd1a hdsd00_1280
# newfs -s 16384 /dev/rrd1e hdsd00_1280
```

The default size of partition *a* for the 1280 Mbyte disk is defined in the file */etc/disktab*. Since it is the same 15884 block size as is in the file */etc/rdtab*, it is not necessary to specify the root file system size.

Since the size of the partition *e* is different from the default size (578023 blocks), it is necessary to specify the size.

Client's file system example 2:

When creating Client's file system on the RAW device after changing the Server partition:

The Client and Server share the same partition of a 1280 Mbyte internal hard disk. As with the former example, it is not necessary to specify the size of the root file system because it is the standard size for the root file system. Specify 38380 blocks to partition *e*.

Create the root file system and */var* file system for the Client *clnt3*.

```
# newfs /dev/rrd0a hdsd00_1280
# newfs -s 38380 /dev/rrd0e hdsd00_1280
```

Create the root file system and */var* file system for the Client *clnt4*.

```
# newfs /dev/rrd1a hdsd00_1280
# newfs -s 40428 /dev/rrd1e hdsd00_1280
```

Client's file system example 3:

When the Clients own the patition */dev/sd00f*

The Clients own a partition of the Server's 1280 Mbyte hard disk.

Create the root file system and */var* file system for he Client *clnt3*.

```
# newfs /dev/rrd0a hdsd00_1280
# newfs -s 38380 /dev/rrd0e hdsd00_1280
```

Create the root file system and */var* file system for the Client *clnt4*.

```
# newfs /dev/rrd1a hdsd00_1280
# newfs -s 55936 /dev/rrd1e hdsd00_1280
```

Client's file system example 4 (hd2861):

When using one portion or all of a connected expansion hard disk of the Server as the Client's file system:

The 286 Mbyte expansion hard disk is used to support the Clients.

Create the root file system and */var* file system for the Client *clnt3*. Since the size of the *clnt3* root file system differs from the default partition size, you must specify the size.

```
# newfs -s 15882 /dev/rrd0a hd2861
# newfs /dev/rrd0e hd2861
```

Create identically the root file system and */var* file system for the Client *clnt4*.

```
# newfs /dev/rrd1a hd2861
# newfs -s 38380 /dev/rrd1e hd2861
```

3.13.2.2 Copying Boot Program

After creating the Client's file system, copy the boot block of the following files for all of the Client's remote disks described in the file */etc/rdtab*.

When the Client is the NWS-700 Series

```
# cd /usr/mdec.news700
# /usr/sony/etc/installboot rd0 rdboot bootrd
```

When the Client is the NWS-800 Series

```
# cd /usr/mdec.news800
# /usr/sony/etc/installboot rd0 rdboot bootrd
```

When the Client is CISC NEWS, excluding the NWS-700/800 Series

```
# cd /usr/mdec.68k
# /usr/sony/etc/installboot rd0 rdboot bootrd
```

When the Client is RISC NEWS

```
# cd /usr/mdec.mips
# /usr/sony/etc/installboot rd0 rdboot bootrd
```

Since Client *clnt3* is RISC NEWS, copy the boot block in the following way.

```
# cd /usr/mdec.mips
# /usr/sony/etc/installboot rd0 rdboot bootrd
```

Since Client *clnt4* is the NWS-700 Series, copy the boot block in the following way.

```
# cd /usr/mdec.news700
# /usr/sony/etc/installboot rd1 rdboot bootrd
```

3.13.2.3 Creating Client's File System

It is necessary to copy the following file systems for each Client.

This operation differs depending on the combination of the CPU family of the Server and Client.

When the CPU family of the Server and Client are the same:

If both the Server and Client are RISC NEWS or CISC NEWS, they can share object files. In these cases, copy the necesary file systems for the Client from the Server file system.

The file systems to be copied are as follows.

- root file system
- */var* file system

Following is an example of Server *serv1* and Client *clnt3*.

1. Copy the root file system

   Use the **dump** command to copy from Server's root file system / to the remote disk for the Client's root file system.

   Copy the Server's root file system to the Client's root file system after mounting the *clnt3* remote disk *rd0a* on */a*.

```
# cd /
# mount /dev/rd0a /a
# cd /a
# dump 0f - / | restore rf -
# cd /
# umount /a
```

2. Copy the */var* file system

   Copy the Server's */var* file system to the Client's */var* file system after mounting the *clnt3* remote disk *rd0e* on */a*

```
# mount /dev/rd0e /a
# cd /var
# tar cf - . |(cd /a ; tar xpvf -)
# cd /
# umount /a
```

When the CPU families of the Server and Client are different:

If the Server is RISC NEWS and the Client is CISC NEWS, they cannot share the same objects. In this case it is necesary to read in the Client's file systems from the NEWS-OS Release 4.0C Installation Kit.

The file systems to be read in are as follows.

- root file system
- /usr file system

Following is an example of Server *serv1* and Client *clnt4*.

1. Read in */usr* file system for the CISC NEWS from the Installation Kit tape.

   Use the **/usr/sony/etc/copyrd** command to read in the file systems under directory */export/CISC*.

   ```
   # mkdir /export/CISC
   # /usr/sony/etc/copyrd -u /export/CISC
   ```

   The CISC NEWS Clients use this */export/CISC/usr* with NFS mounting.

   [Note]
   This directory cannot be created in the example 3. In this case, read in the files to another file system.

2. Add the following line in the file */etc/exports* to export the CISC NEWS */usr* file system.

   ```
   /export/CISC/usr -ro
   ```

3. Execute the **exportfs** command to export the directory of the added entry.
   First unexport all of the directories presently exported, then export all of the entries entered in the file */etc/exports*.

   ```
   # exportfs -a -u
   # exportfs -a
   ```

   [Note]
   The Client uses the */usr* file system with NFS mounting. Because of this, even when several CISC NEWS Clients are supported, it is necessary to read in the */usr* file system only once from the NEWS-OS Realease 4.0C Installation Kit.

4. Use the **/usr/sony/etc/copyrd** command to read in the root file system for the CISC NEWS to the remote disk of the Client's root file system. At this time the */var* file system is read in.

   First, mount the remote disk *rd1a* of the *clnt4* root file system on */a*. Create the directory for the */var* file system under */a*. Mount remote disk *rd1e* of the *clnt4* */var* file system under */a/var*, then use the **/usr/sony/etc/copyrd** command to read in the root file system.

```
# mount /dev/rd1a /a
# mkdir /a/var
# mount /dev/rd1e /a/var
# /usr/sony/etc/copyrd -r /a
# cd /
# umount /a
```

[Note]
It is necessary to set up a root file system and */var* file system for each Client. When several CISC NEWS Clients are supported, either read in the root and */ver* file systems for each Client from the NEWS-OS Release 4.0C Installation Kit using the **/usr/sony/etc/etc/copyrd** command, or copy the root and */var* file systems of another Client using the **tar** command.

5. Create a special file

When reading a root file system using the **/usr/sony/etc/copyrd** command, special files under the directory */dev* of the Client will not be created.
It is necessary to create the following special files.

Client	Necessary Special Files
NWS-700 Series	std fb fb0 pty0 pty1 keyboard mouse rd0
Others	std fb fb0 pty0 pty1 keyboard mouse rd0 rs0 sb fd0 lp0

First, mount the remote disk *rd1a* of the *clnt4* root file system to */a*, and create the Client *clnt4* special files as follows.

```
# mount /dev/rd1a /a
# cd /a/dev
# sh MAKEDEV std pty{0,1} fb fb0 keyboard mouse rd0
# cd /
# umount /a
```

3.13.2.4 Copying Kernel Program

Copy the kernel program to the Client's root file system. For the NWS-800 Series, also copy *iopboot.* The kernel program and the *iopboot* used for the diskless workstations are installed by selecting the item, "diskless", at the time of installation.

Client	Kernel	iopboot
NWS-700 Series	/sys/OBJ.news700/rdvmunix	–
NWS-800 Series	/sys/OBJ.news800/rdvmunix	/sys/OBJ.news800/iopboot
NWS-1500 Series	/sys/OBJ.news1400/rdvmunix	–
NWS-1700 Series	/sys/OBJ.news1700/rdvmunix	–
NWS-3400 Series	/sys/OBJ.news3400/rdvmunix	–
NWS-3700 Series	/sys/OBJ.news3700/rdvmunix	–

[Note]
Perform the additional installation when these kernel programs are not present in your system.

When the Client is the NWS-700 Series

1. Copy the kernel program and the boot program to the root file system of the Client

```
# mount /dev/rd0a /a
# cp -p /sys/OBJ.news700/rdvmunix /a/vmunix
# cp -p /usr/mdec.news700/boot /a/boot
```

2. Unnecessary files such as *iopboot* and *mrx* may exist depending on the source of the copy. Erase them, if there are.

```
# rm -f /a/.{iopboot,mrx}
# umount /a
```

When the Client is the NWS-800 Series

1. Copy the kernel program, *iopboot,* and boot program to the root file system of the Client.

```
# mount /dev/rd0a /a
# cp -p /sys/OBJ.news800/rdvmunix /a/vmunix
# cp -p /sys/OBJ.news800/iopboot /a/iopboot
# cp -p /sys/mdec.news800/boot /a/boot
```

2. Unnecessary file such as *mrx* may exist depending on the source of the copy. Erase them, if there is.

```
# rm -f /a/mrx
# umount /a
```

When the Client is the NWS-1500 Series

1. Copy the kernel program and boot program to the root file system of the Client.

```
# mount /dev/rd0a /a
# cp -p /sys/OBJ.news1400/rdvmunix /a/vmunix
# cp -p /sys/mdec.68k/boot /a/boot
```

2. Unnecessary files such as *iopboot* and *mrx* may exist depending on the source of the copy. Erase them, if there are.

```
# rm -f /a/{iopboot,mrx}
# umount /a
```

When the Client is the NWS-1700 Series

1. Copy the kernel program and boot program to the root file system of the Client.

```
# mount /dev/rd0a /a
# cp -p /sys/OBJ.news1700/rdvmunix /a/vmunix
# cp -p /sys/mdec.68k/boot /a/boot
```

2. Unnecessary files such as *iopboot* and *mrx* may exist depending on the source of the copy. Erase them, if there are.

```
# rm -f /a/{iopboot,mrx}
# umount /a
```

When the Client is the NWS-3400 Series

1. Copy the kernel program and boot program to the root file system of the Client.

```
# mount /dev/rd0a /a
# cp -p /sys/OBJ.news3400/rdvmunix /a/vmunix
# cp -p /sys/mdec.mips/boot /a/boot
```

2. Unnecessary file such as *mrx* may exist depending on the source of the copy. Erase them, if there is.

```
# rm -f /a/mrx
# umount /a
```

When the Client is the NWS-3700 Series

1. Copy the kernel program and boot program to the root file system of the Client.

```
# mont /dev/rd0a /a
# cp -p /sys/OBJ.news3700/rdvmunix /a/vmunix
# cp -p /sys/mdec.mips/boot /a/boot
```

2. Unnecessary file such as *mrx* may exist depending on the source of the copy. Erase them, if there is.

```
# rm -f /a/mrx
# umount /a
```

For Client *clnt3*, copy the kernel program and boot program after mounting the remote disk *rd0a* for the root file system on */a*.

```
# mount /dev/rd0a /a
# cp -p /sys/OBJ.news3400/rdvmunix /a/vmunix
# cp -p /sys/mdec.mips/boot /a/boot
# rm -f /a/mrx
# umount /a
```

For Client *clnt4*, copy the kernel program and boot program after mounting remote the disk *rd1a* for the root file system on */a*.

```
# mount /dev/rd1a /a
# cp -p /sys/OBJ.news700/rdvmunix /a/vmunix
# cp -p /usr/mdec.news700/boot /a/boot
# rm -f /a/{iopboot,mrx}
# umount /a
```

3.13.2.5 Creating Architecture Dependent Command Path

When the Client is CISC NEWS, you have to create the command path which is dependent on the architecture. In CISC NEWS, there are two architectural groups: mc68020 and mc68030.

Client	Architecture
NWS-700 Series	mc68020
NWS-800 Series	
Another CISC NEWS	mc68030

The commands dependant on these architectures are in the directory mc68020 and mc68030, respectively, under the Client's */usr/arch* directory. Make a symbolic link to the Client's */sbin/arch* to the above directory according to its architecture.

Since the architecture of the Client *clnt4* is mc68020, make a symbolic link to */usr/arch/mc68020* for the Client.

```
# mount /dev/rd1a /a
# cd /a/sbin
# rm -f arch
# ln -s ../usr/arch/mc68020 arch
# cd /
# umount /a
```

3.13.2.6 Other Setups

The following setups are also occasionally necessary in the Client.

- Timezone setup
- Keymap change

For implementation of these setups, refer to the section "Files Generated in the Full Instruction" in the chapter "NEWS-OS Full Installation (from Tape)" in the NEWS-OS Release 4.0 Installation Kit Instruction Manual.

3.13.3 Setting Up Client's Files

By now, the Client's file system has been installed and the necessary directories and files for the Client's file system have been either created or copied. Now change the necessary Client's files in the Client's file system to enable a normal boot from the Server.

- Confirm Client's */etc/hosts* file
- Change Client's */etc/rc.custom* file
- Change Client's */etc/fstab* file
- Change Client's */etc/rc.net* file
- Erase Client's */etc/rdtab* file
- Change Client's */etc/exports* file
- Erase Client's */etc/ethers* file
- Erase Client's */etc/bootptab* file
- Erase Client's */etc/bootparams* file

All of these operations are carried out in the Server. Do not mistakenly change a Server's file.

Following is an example using mostly Client *clnt3.*

3.13.3.1 Confirm Client's */etc/hosts* File

Copy the Server's */etc/hosts* file to the Client's file system. As in the example of the Client *clnt3,* the Server's root file system has already been copied since the CPU family of the Server and Client are the same; therefore, this operation is unnecessary. Confirm whether or not the information of the Server and Client have been entered correctly.

This example shows Client *clnt4* whose CPU family differs from the Server.

```
# mount /dev/rd1a /a
# cp -p /etc/hosts /a/etc
# mkhosts /a/etc/hosts
# umount /a
```

3.13.3.2 Changing Client's */etc/rc.custom* File

Enter the information peculiar to the Client in the Client's */etc/rc.custom* file.

1. Change the HOSTNAME to the Client's host name and, change BROADCAST and NETMASK to the same parameters used for the Server.

   Mount the remote disk *rd0a* of the Client *clnt3* root file system on */a.*

   ```
   # mount /dev/rd0a /a
   ```

   Here, the Client *clnt3* */etc/rc.custom* file is */a/etc/rc.custom* in the Server.

   Change the entry of the file */a/etc/rc.custom* as follows:

   ```
   HOSTNAME = serv1
            :
   BROADCAST=100.255.255.255
            :
   NETMASK=255.0.0.0
   ```

   ↓

   ```
   HOSTNAME=clnt3
            :
   BROADCAST=100.255.255.255
            :
   NETMASK=255.0.0.0
   ```

   [Note]
   Since the Server's root file system has already been copied because the CPU family of the Server and Client are the same, it is only necessary to change the host name.

2. In the Client, set up to invoke the */etc/timed* as slave. To invoke */etc/timed* as slave, enter *"slave"* after **TIMED=** in the Client's */etc/rc.custom* file. Actually, */etc/timed* is invoked from the script file */etc/rc.net.*

   Change the entry of the file */a/etc/rc.custom* as follows:

   ```
   TIMED=master
   ```

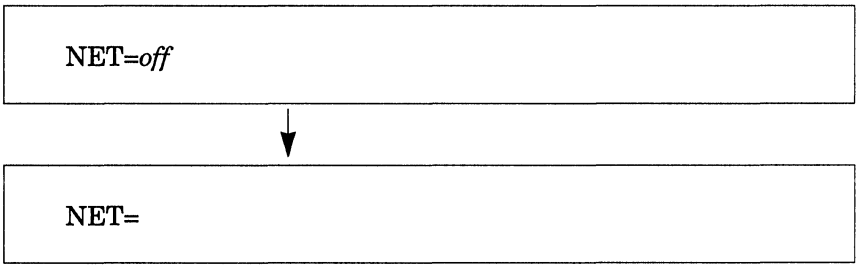
   ↓

   ```
   TIMED=slave
   ```

3. Set up the network environment.

When "*off*" is written after **NET=** of the Client */etc/rc.custom* file, the network is unuseable. To use the network, erase the word "*off*" or write over it with other characters.

Change the entry of the file */a/etc/rc.custom* as follows:



4. **umount** when the necessary changes are complete.

```
# mount /a
```

3.13.3.3 Changing Client's */etc/fstab* File

Refer to the following example to mount the Client's file system and change the */etc/fstab* file.

[Note]
Be aware that the remote disk name used in the Client's */etc/fstab* file is *"rd0."*

When the CPU family of the Server and Client are the same:

Since the Server and Client are both RISC NEWS in an example of the Client *clnt3,* use the Server *serv1*'s */usr* with NFS mount.

```
# cd /
# mount /dev/rd0a /a
```

Change the entry of the file */a/etc/fstab* as follows:

```
/dev/rd0a       /       4.3 rw          1  1
/dev/rd0e       /var    4.3 rw          1  2
serv1:/usr      /usr    nfs ro,noauto   1  9
```

```
# umount /a
```

When the CPU families of the Server and Client are different:

For Client *clnt4*, since the Server is RISC NEWS and the Client is CISC NEWS, use */usr* for CISC NEWS which was read in to the Server with the NFS mount.

```
# cd /
# mount /dev/rd1a /a
```

Change the entry of the file */a/etc/fstab* as follows:

```
/dev/rd0a                 /      4.3    rw          1   1
/dev/rd0e                 /var   4.3    rw          1   2
serv1:/export/CISC/usr    /usr   nfs    ro,noauto   1   9
```

```
# umount /a
```

[Note]
Do not write any blank lines in the file */etc/fstab*.

3.13.3.4 Erasing Client's */etc/rdtab* File

Since the file */etc/rdtab* is unnecessary in the Client, erase it from the Client's file system. Do the same thing to each supporting Clients: *clnt3* (*/dev/rd0a*) and *clnt4* (*/dev/rd1a*).

```
# cd /
# mount /dev/rd0a /a
# rm -f /a/etc/rdtab
# umont /a
```

3.13.3.5 Changing Client's */etc/exports* File

The NFS mounted remote file systems (such as */usr*) cannot be entered in the */etc/exports* file. For this reason, erase or comment out the entries of the NFS mounted directories from the Client's */etc/exports* file. Apply the same changes toward each supporting Clients: *clnt3* (*/dev/rd0a*) and *clnt4* (*/dev/rd1a*).

```
# cd /
# mount /dev/rd0a /a
```

Change the entry of the file */a/etc/exports.* Comment out the entry by placing the # comment mark at the head of a line.

```
/usr            -ro
/export         -ro
```

↓

```
#/usr           -ro
#/export        -ro
```

```
# umount /a
```

3.13.3.6 Changing Client's */etc/rc.net* File

1. Comment out the portions which start up */etc/rarpd, /usr/etc/rpc.bootparamd, /usr/etc/rdd,* and */etc/nfsd* described in the Client's */etc/rc.net* file, by placing the # comment mark at the head of each line.

```
# cd /
# mount /dev/rd0a /a
```

Change the entry of the */a/etc/rc.net* file as folilows:

```
if [ -f /etc/nfsd -a -f /etc/exports ]; then
        /etc/nfsd 4 & echo -n 'nfsd'                    >/dev/console
fi
        :
if [ -f /usr/etc/rpc.bootparamd ]; then
        /usr/etc/rpc.bootparamd & echo -n 'bootparamd'  >/dev/console
fi
        :
if [ -f /etc/rarpd ]; then
        /etc/rarpd; echo -n 'rarpd'                     >/dev/console
fi
        :
if [ -f /etc/rdd -a -f /etc/rdtab ]; then
        /etc/rdd 4; echo -n 'rdd'                       >/dev/console
fi
```

↓

```
# if [ -f /etc/nfsd -a -f /etc/exports ]; then
#         /etc/nfsd 4 & echo -n 'nfsd'                    >/dev/console
# fi
        :
# if [ -f /usr/etc/rpc.bootparamd ]; then
#         /usr/etc/rpc.bootparamd & echo -n 'bootparamd'  >/dev/console
# fi
        :
# if [ -f /etc/rarpd ]; then
#         /etc/rarpd; echo -n 'rarpd'                     >/dev/console
# fi
        :
# if [ -f /etc/rdd -a -f /etc/rdtab ]; then
#         /etc/rdd 4; echo -n 'rdd'                       >/dev/console
# fi
```

2. Add the following entry to the Client's */etc/rc.net* file to startup */etc/rdx*.

```
#if [ -f /etc/rdd -a -f /etc/rdtab ]; then
#       /etc/rdd 4; echo -n 'rdd'                 >/dev/console
#fi
```

↓

```
# if [ -f /etc/rdd -a -f /dev/rdtab ]; then
#         /etc/rdd 4; echo -n 'rdd'               >/dev/console
# fi
if [ -f /etc/rdx -a -f /dev/rrd0a ]; then
        /etc/rdx 4; echo -n 'rdx'                 >/dev/console
fi
```

```
# umount /a
```

3.13.3.7 Changing Other Client's Files

The following file are occasionally necessary to be setup depending on the Client's system.

- Client's */etc/ttys* file
- Client's */etc/sysinfo* file

Concerning these, refer to the section "Files Generated by the Full Instsllation" in the chapter "NEWS-OS Full Installation (from Tape)" in the NEWS-OS Release4.0 Installation Kit Instruction Manual.

3.14 System Operation

The operations of the Server and Client for diskless workstations are almost identical to the operations of a standalone workstations except for the order of the system startup (boot) and shutdown.

Following is an explanation concerning the operation of a diskless workstation.

3.14.1 Booting Up the System

When booting a diskless workstation, boot up the Server first.

You can either boot up the system in auto boot or manual boot.
Auto boot boots up the system, when the power is switched on. Manual boot boots up the system manualy from the ROM monitor. Even when setting up an autoboot, first set up the manual boot and confirm that the diskless Server/Client settings are correct. Once the Client system starts up and operation is confirmed, set to the autoboot.

Following ON/OFF dip switch switches autoboot to manual boot.

NWS-700 Series: dip swith #1 on the back panel
Other series: dip switch #5 on the front panel

If a Client's ROM monitor supports the tftp boot using NFS, set the boot device as *tftp* and boot up. With other setups, set the boot device as *rd* and boot up so that the Client workstation will boot up from the remote disk.

3.14.1.1 When Boot Device Is *tftp*

Autoboot

1. Set the autoboot/manual boot dip switch to OFF, turn on the power, and start up the ROM monitor.

2. Enter the following command at the ROM monitor command line and set the boot device to tftp. Even if the power is turned off, this setup remains.

```
NEWS> set bootdev=tftp
```

3. Turn off the power.

4. Set the autoboot/manual boot dip switch to ON.

5. Turn on the power. The system starts up.

From now on, the system will start up automatically when the power is turned on.

[Note]
Enter the following command when unsetting the boot device.

```
NEWS> set bootdev
```

Manual Boot

1. Set the autoboot/manual boot dip switch to OFF.

2. Enter the following command at the ROM monitor command line. The system will start up.

```
NEWS> bo +
```

You can boot the system without specifying a plus sign if the boot device is set up to use tftp as in step2 in Autoboot example.

```
NEWS> bo
```

3.14.1.2 When Boot Device Is *rd*

Autoboot

1. Set the autoboot/manual boot dip switch to ON.

2. Turn on the power.

Manual boot

1. Set the autoboot/manual boot dip switch to OFF.

2. Enter the following command at the ROM monitor command line.

```
NEWS> bo rd
```

3.14.2 Shutdown

Use the **shutdown** command when shutting down a diskless workstation. Make sure to shutdown all of the Clients first, and then **shutdown** the Server.
When the Server is shutdown before the Clients, there is a risk that the Client's data will be destroyed. Should the Server be shutdown before the Clients, reboot the Server and then shutdown the Clients.

Chapter

4

I/O Interface

This chapter describes the I/O interfaces which are provided as a standard feature or options for the NEWS system.

Contents

4.1 VMEbus

VMEbus (VME: Versa Module Europe) is a standard popularly used in design and packaging of electronic systems. For detailed explanation of VMEbus specifications, refer to the following materials:

"VMEbus system Architecture Manual
SPECIFICATION Revision C.1"
that is prepared by

MOTOROLA Microcomputer Division
2900 S. Diablo Way, Tempe, Arizona 85282
For Further Information Phone 1-800-556-1234 Ext. 230
In California 1-800-441-2345 Ext. 230 In Australia call: 61-2-438-955
In Canada call: 416-793-5700 In Europe call: 44-628-39121 In Hong Kong call: 852-5-666706
In Japan call: 81-3-588-8949 as of December 1988.

Same kind of book is prepared by IEEE.
"VME Specification Manual Revision C.1"

This chapter describes specific remarks pertaining to the VMEbus based equipment, which are available as NEWS series products.

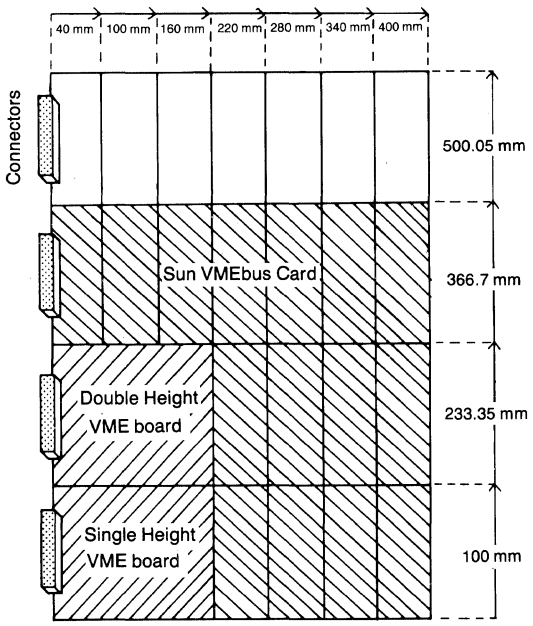
4.1.1 VMEbus Standard Sizes

The board sizes specified by the VMEbus standards are the following:

Single height	100 × 160 × 1.6 (mm)
Double height	233.35 × 160 × 1.6 (mm)

Thus, boards which are designated as "standard VMEbus module products" are designed to meet the above size specifications. However because the above sizes are small, there are a variety of machines which offer different sizes while retaining the signal specifications of the VMEbus. Although the sizes differ the majority do match Eurocard standard specifications. As shown in Figure 4.1-1, the height and length of the Eurocard standard can be chosen from any number of combinations, and the VMEbus' standard size height and length were chosen from the Eurocard standard.

Fig. 4.1-1 Eurocard Size



4.1.2 Sizes of VMEbus Boards Supplied for the NEWS Series

For the NEWS series, only VME box NWP-413 uses the standard VMEbus board size. The other VME slots use different sizes chosen from Eurocard standard specifications. The slot sizes for NWS-1930 are the same as those chosen by Sun workstations and it is physically possible to insert most of Sun's boards into the NWS-1930 slots (although because the operating systems differ the software must be customized to use Sun's boards with NEWS systems)

Model	Board	Height (mm)	Length (mm)	Thickness (mm)
NWP-413	Double height VME board	233.35	160	1.6
NWP-414	Double height Eurocard	233.35	280	1.6
900 Series, NWS-1960	Triple height Eurocard	366.7	280	1.6
NWS-1930	Sun VME bus Card	366.7	400	1.6

Note: Pay additional attention to the following remarks:

(1) NWS-1930 can be only plugged in Sun VMEbus cards.

(2) The 900 series and NWS-1960 with the extension through NWA-030 (Double height VME board Adaptor Set), can use Double height Eurocard (standard size).

(3) NWP-414 is a VME Box specifically developed to accommodate for NWB-224 (Full Color Graphic Interface Board) and NWB-226 (VTR Control Interface Board). NWB-224 occupies 3 slots for use.

4.1.3 Availability of VMEbus Slots in the NEWS series

The 900 series and 1900 series are both equipped with VMEbus slots in the main units. The 800, 1700 and 1800 series have provision of extension to interface VMEbus modules through peripheral equipment (NWP-413/414). Availability of a number of VMEbus slots, in comparison, with these systems are as follows:

Model	Slot Counts	Remarks
NWP-413 **NWP-414**	4 4	1 out of 5 slots is for exclusive use of the VMC Interface Board
900 series, NWS-1960	4	1 out of 5 slots is for exclusive use of VMEbus Interface Board
NWS-1930	5	1 out of 6 slots is for exclusive use of VMEbus Interface Board

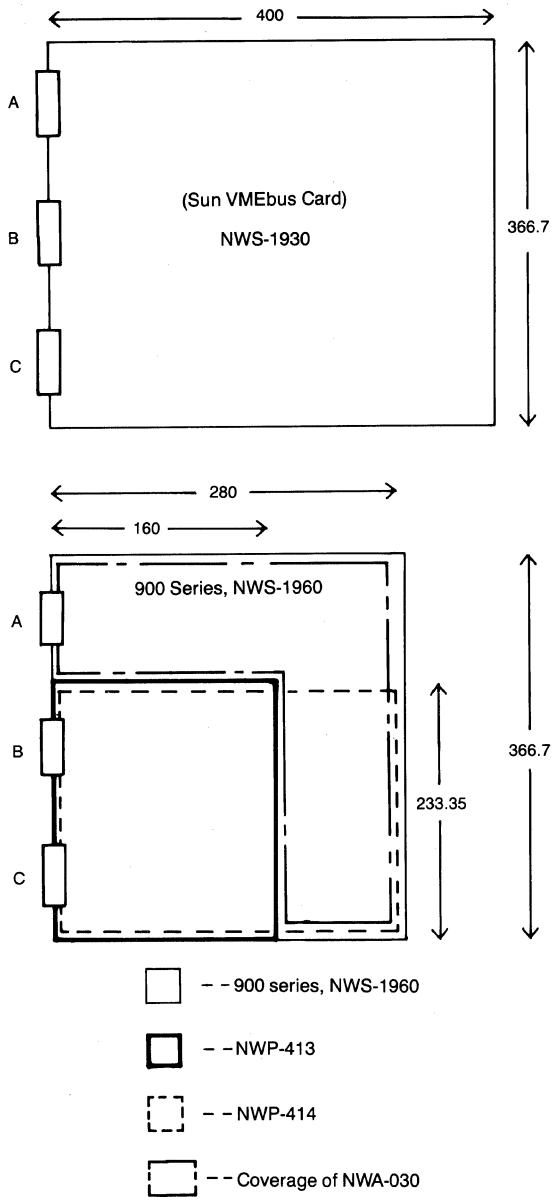
Note: The peripheral equipment (NWP-413 or 414) for VMEbus extension of the 800, 1700, 1800 series, requires the interface board and NWB-234A, for connection with the main system.

4.1.4. VME Board Size and the Related Products

The products described in the above and their relation to the board sizes, along with the connector arrangement, are shown in the following figure and table:

	900 series, NWS-1960 (NWP-413, 414)	NWS-1930
A	SONY	VME J1
B	VME J1	VME J2
C	VME J2	SUN

Model vs Connector



4.2 Serial Port

The NEWS series are equipped, with two standard RS-232C Serial Interface ports (with the exception of 700 series). RS-232C is a Standard of Serial Interface which is set by EIA (USA) conforming to the CCITT's V.24, V.28 Recommendations, and the standard encompasses electrical specifications of signal lines, types and functions of signal lines, mechanical characteristics (such as connector specifications), etc. Described in the following are the specifics as related to the NEWS series products, leaving general information on the subject to other documents.

4.2.1 Expansion of Serial Port

(1) NWV-231A (4ch Serial Interface Board): One card can be used for expansion of 4 channels of serial interface. Also, selection of RS-232C or RS-422A is possible with this card. The main NEWS unit can accommodate up to 2 cards of NWB-231A. Therefore, a unit of NEWS can be equipped with a maximum of 10 channels of serial ports including the 2 ports provided as standard in the main unit.

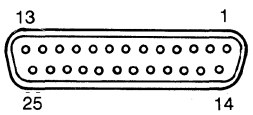
(2) NWB-232A (GP-IB Interface Board): One card can be used for expansion of a channel of GP-IB, 2 channels of RS-232C and a channel of RS-422A interfaces.

4.2.2 Interface Specifications

- Baud rate Max. 9600 bps for system RS-232C; for NWB-231A and NWB-232A baud rate Max. 19200
- Asynchronous Transfer, Synchronous Transfer possible
- Use of external clock possible

Fig. 4.2-1 shows the specifications of 25-pin Serial Port Connector.

Fig. 4.2-1 RS-232C Connector

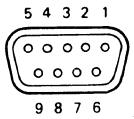


Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	FGND	8	DCD	15	TXclock (input)	22	RI
2	TXD	9		16		23	
3	RXD	10		17	RXclock (input)	24	
4	RTS	11		18		25	
5	CTS	12		19			
6	DSR	13		20	DTR		
7	GND	14		21			

Fig. 4.2-2 shows the specifications of 9-pin connector when used as an RS-232C interface.

Fig. 4.2-3 shows the specifications of 9-pin connector when used as an RS-422A interface.



Connector

Fig. 4.2-2 RS-232C Interface

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	DCD	4	DTR	7	RTS
2	RXD	5	GND	8	CTS
3	TXD	6	DSR	9	RI

Fig. 4.2-3 RS-422A Interface

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1		4		7	TRANSMIT +
2	TRANSMIT −	5	GND	8	RECEIVE +
3	RECEIVE −	6		9	

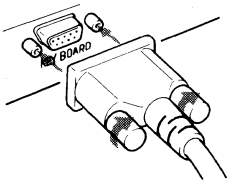
Note: When using the board as an RS-422A serial interface, do not connect signal lines to pins for which no signals are assigned in the above table.

For serial interface operating procedures, refer to respective NETWORK STATION operating instructions.

4.2.3 RS-232C Cable

6 types are available for your selection depending on the equipment to be connected.

Cable Type	Connectible Equipment
Terminal Cable **NWA-011**	Connection cable between NWB-231A Expansion Board and NWP-511F 14-inch Kanji Terminal; 9 pin — 25 pin, 5 meter length
Modem Cable **NWA-012**	Connection cable between NWB-231A Expansion Board and modems available on retail market; 9 pin — 25 pin, 5 meter length
Terminal Cable **NWA-013**	Connection cable between NEWS series network station or NWB-232A Expansion Board and NWP-511 14-inch Kanji Terminal; 25 pin — 25 pin, 5 meter length
Modem Cable **NWA-014**	Connection cable between NEWS series network station or NWB-232A Expansion Board and modems available on retail market; 25 pin — 25 pin, 5 meter length
PC Cable **NWA-015**	Connection cable between NWB-231A Expansion Board and personal computers available on retail market; 9 pin — 25 pin, 5 meter length
PC Cable **NWA-016**	Connection cable between NEWS series network station or NWB-232A Expansion Board and personal computers on retail market; 25 pin — 25 pin, 5 meter length



Connected as illustrated

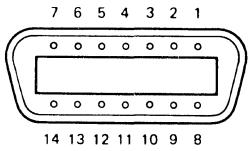
4.3 Parallel Port

The main unit of NEWS (with the exception of 700 series) is equipped, as a standard interface, with a parallel port of Centronics specifications. The Centronics Interface is a standard developed by Centronics, Inc., USA, for a computer to transfer data to a printer, which provides economical means of data transfer at high speed. Input and output operations of signal lines are all interfaced at TTL level, and any printer, whether it is a low speed type or a high speed type, can be synchronized with CPU.

4.3.1 Interface Specifications

NEWS has a 14-pin parallel port connector, whose specifications are as shown in Fig. 4.3-1.

Fig. 4.3-1 Parallel Port Interface Specifications



Parallel Port Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	STRB	6	D4	11	BUSY
2	D0	7	D5	12	
3	D1	8	D6	13	FAULT
4	D2	9	D7	14	GND
5	D3	10			

4.4 GP-IB

GP-IB (General Purpose Interface Bus) is a Standard set in 1978 by the US Institute of Electrical and Electronics Engineers (IEEE), which is a digital interface also known as IEEE-488.
The explanation here covers only the specifics on GP-IB products supplied in pertinence to NEWS series systems.

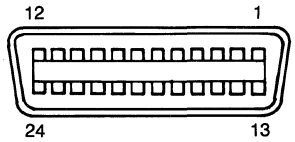
4.4.1 Securing of GP-IB Interface

1 channel of GP-IB can be secured by mounting a NWB-232A (GP-IB Interface Board) with the main unit of NEWS (not including 700 series). NWB-232A additionally provides 2 channels of RS-232C and one channel of RS-422A at the same time.

4.4.2 Interface Specifications

Fig. 4.4.1 represents GP-IB connector specifications, while Table 4.4.1 explains GP-IB signal lines and their respective functions.

Fig. 4.4-1 Interface Specifications



GP-IB Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	DIO1	7	NRFD	13	DIO5	19	GND
2	DIO2	8	NDAC	14	DIO6	20	GND
3	DIO3	9	IFC	15	DIO7	21	GND
4	DIO4	10	SRQ	16	DIO8	22	GND
5	EOI	11	ATN	17	REN	23	GND
6	DAV	12	FGND	18	GND	24	GND

Table 4.4-1 GP-IB Signal Lines & Functions

	Signal Line	Function		
Data Bus	DIO1 (Data Input/Output 1) DIO2 (Data Input/Output 2) DIO3 (Data Input/Output 3) DIO4 (Data Input/Output 4) DIO5 (Data Input/Output 5) DIO6 (Data Input/Output 6) DIO7 (Data Input/Output 7) DIO8 (Data Input/Output 8)	Data Transmission Data Example: Command Address Measurement Data Status		
Transmission Control Line	DAV (Data Valid) NRFD (Not Ready For Data) NDAC (Not Data Accepted)	Data Validity Data Reception Ready (at NRFD = 0) Data Accepted (at NDAC = 0)		Handshake connection
Supervising Line	ATN (Attention)	Data Classification	1: Interface Message 0: Device Message	
	IFC (Interface Clear)		Interface Initialization	
	SRQ (Service Request)		Service Request	
	REN (Remote Enable)		Remote/Local Switching	
	EOI (End or Identify)		Indicate Last Byte of Data (at ATN = 0) Indicate parallel port in execution (at ATN = 1)	

Note: Bus is all negative logic. (0 = "H", 1 = "L" level)

4.5 SCSI Interface

SCSI (Small Computer System Interface) is an interface specifically designed for microcomputer systems, and adopted as a Standard by ANSI (American National Standards Institute) in July, 1986. Through introduction of this standard, a host has now only to deal with the simplified interface, freed from complicated controls of peripherals, leaving such work to a controller. The NEWS series (with the exception of 700 series) provide 1 channel of SCSI interface as standard. Plural number of SCSI interface equipment can be controlled from a host when connected in a daisy chain mode.

The following peripherals are supplied with SCSI interface:

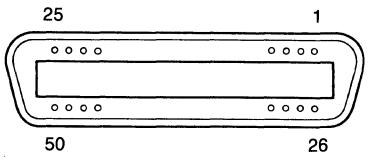
NWP-531	Streaming Tape Unit (60MB)
NWP-536	Streaming Tape Unit (125MB)
NWP-536A	Streaming Tape Unit (125MB)
NWP-532	Expansion Hard Disk Unit (156MB formatted)
NWP-535	Expansion Hard Disk Unit (286MB formatted)
NWP-535A	Expansion Hard Disk Unit (286MB formatted)
NWP-539S	MO Disk Unit

4.5.1 SCSI Bus Connector Specifications

- 50-pin Connector
- ANSI Standard Specifications X3T9.2

Fig. 4.5-1 shows SCSI Bus specifications.

Fig. 4.5-1 Interface Connector Specifications



SCSI Bus Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	GND	14	GND	27	DB1	40	GND
2	GND	15	GND	28	DB2	41	ATN
3	GND	16	GND	29	DB3	42	GND
4	GND	17	GND	30	DB4	43	BSY
5	GND	18	GND	31	DB5	44	ACK
6	GND	19	GND	32	DB6	45	RST
7	GND	20	GND	33	DB7	46	MSG
8	GND	21	GND	34	DBP	47	SEL
9	GND	22	GND	35	GND	48	C/D
10	GND	23	GND	36	GND	49	REQ
11	GND	24	GND	37	GND	50	I/O
12	GND	25	GND	38	+5V		
13		26	DB0	39	GND		

4.6 Network Port

The NEWS series provide, as a network port, 10M bps Ethernet transceiver interface which has 15 pin connector.

4.6.1 Network Port Expansion

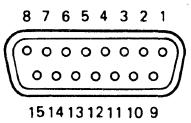
Addition of a NWB-235A (Expansion Network Board) can provide 1 additional channel of Ethernet Interface. The main unit of NEWS can accommodate a maximum of 2 additional Expansion Network Boards. A maximum of 3 channels of Ethernet Interface, therefore, can be installed and used with a unit of NEWS. Purchase of a NWA-021 (Network Starter Kit) enables 2 units of NEWS to be connected, and for further connection, purchase of NWA-022 (Transceiver Kit) enables up to 9 units of NEWS to be connected to an Ethernet segment.

Note: Mounting of NWA-022 requires special tool NWA-023.

4.6.2 Network Connector Specifications

Fig. 4.6-1 shows Network Connector specifications.

Fig. 4.6-1 Network Connector Specifications



Network Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	Shield	6	Return	11	
2	Collision +	7		12	Receive −
3	Transmit +	8		13	Power
4		9	Collision −	14	
5	Receive +	10	Transmit −	15	

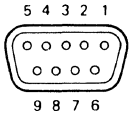
4.7 Keyboard Connector

Keyboard Connector, provided with each of the NEWS series, is a 9-pin connector to handle TTL level serial transfer interface. Keyboard (NWP-411) also includes a Mouse device.

4.7.1 Keyboard Connector Specifications

Fig. 4.7-1 shows Keyboard Connector Specifications.

Fig. 4.7-1 Keyboard Connector Specifications



Keyboard Connector

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	+5V	4	reserved	7	Mouse data
2	Buzzer	5	GND	8	reserved
3	Key data	6	reserved	9	

4.7.2 Mouse Connector Specifications

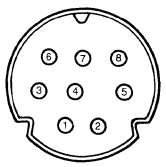
1. Outline

   TTL serial non-polling type.

   1200 baud rate.

2. Pin arrangement

Fig. 4-7-2 Mouse Connector Specifications



Mouse Connector

Pin No.	output
4	Vc (+5V)
5	GND
6	TXD

Vc: supplied voltage
TXD: transfered data from mouse

3. Power supply

Vc:	operation voltage	DC5V ±10%
Vmax:	Maximum Const.	7V
Ic:	consumption current	less than 20mA (Vc=5V)

4. Input output level

V (OL) = less than 0.4V (logic 0)

V (0H) = more than 2.4V (logic 1)

5. Serial protocol

Baud rate 1200 baud ±2%

data bit structure (transfered from LSB side)

start bit 1 bit

stop bit 2 bit

data 8 bit

no parity

bit	S	X	Y
0	SW1	X0	Y0
1	SW2	X1	Y1
2	SW3	X2	Y2
3	X7	X3	Y3
4	Y7	X4	Y4
5	0	X5	Y5
6	0	X6	Y6
7	1	0	0

Definition

SW1, SW2, SW3	conditions of select SW
	SW ON. . . . 1
	SW OFF . . . 2
X0 — X7	Data of X direction (X7: MSB)
	Binary 8 bit
	nagative No. is shown by 2's complement
Y0 — Y7	Data of Y direction

Data block

S	X	Y

Chapter

5

Power Requirements

The actually measured value (partially including a theoretical value and catalog value) in the power and current consumptions of NEWS-related products is described in this chapter. When constructing the system, calculate the power capacitance referring to the description in this chapter. Since the actually measured value is described, the value may differ from the value described in the catalog or manual. Each value is classified as follows according to the difference in voltage:

100V specification: For J (Japan)

120V specification: For UC (USA and Canada)

220V specification: For EK (Europe and United Kingdom)

Table of Contents

5.1 NWS (System) Series Power Consumption

NWS Series Power Consumption

Model	For J [100V]	For UC [120V]	For EK [220V]	Remarks
NWS-711	1.8A 100W	1.5A 100W	—	
NWS-712	—	—	0.5A 50W	
NWS-721	1.2A 70W	1.1A 70W	0.7A 75W	
NWS-811	1.4A 80W	—	—	
NWS-821	1.8A 110W	—	—	
NWS-831	1.8A 110W	—	—	
NWS-841	1.8A 110W	1.5A 110W	—	
NWS-891	2.1A 156W	—	—	
NWS-911	4A 240W	—	—	
NWS-921	5A 240W	—	—	
NWS-1230	1.2A 60W	—	—	
NWS-1250	1.2A 60W	—	0.5A 60W	
NWS-1410	2.0A 55W	—	—	
NWS-1450	1.2A 65W	—	—	
NWS-1460	1.2A 65W	—	—	
NWS-1510	—	—	0.6A 55W	
NWS-1520	—	—	0.6A 55W	
NWS-1530	—	—	0.6A 55W	
NWS-1580	—	—	0.6A 65W	
PWS-1520	1.0A 50W	—	—	
PWS-1550	1.2A 65W	—	—	
PWS-1560	1.2A 65W	—	—	
PWS-1630	1.23A 55W	—	—	
NWS-1710	—	1.13A 55W	—	
NWS-1720	1.56A 68W	1.40A 68W	0.69A 68W	
NWS-1750	1.78A 75W	1.62A 75W	0.79A 75W	
NWS-1830	1.80A 80W	1.62A 85W	0.93A 85W	
NWS-1850	2.12A 105W	1.92A 105W	1.04A 105W	

Model	For J [100V]	For UC [120V]	For EK [220V]	Remarks
NWS-1860	2.0A 90W	—	—	
NWS-1930	—	5A 360W	2.7A 360W	
NWS-1960	5.5A 330W	—	—	
NWS-3250	—	1A 80W	—	
NWS-3260	1.2A 80W	—	0.5A 80W	
NWS-3410	3.5A 70W	—	—	
NWS-3410 (Type A)	—	—	2A 70W	
NWS-3410 (Type D)	—	—	2A 80W	
NWS-3410 (Type F)	—	—	2A 80W	
NWS-3460	3.5A 80W	—	—	
NWS-3710 (Type A)	—	6A 70W	—	
NWS-3710 (Type D)	—	6A 80W	—	
NWS-3710 (Type F)	—	6A 80W	—	
NWS-3720	6A 85W	—	—	
NWS-3840	6A 110W	—	—	
NWS-3860	6A 120W	—	3A 120W	
NWS-3865	—	—	3A 120W	
NWS-3870	6A 120W	5A 120W	—	

The value described in this table indicates an actually measured value unless otherwise specified.

[Note]
The amperage given for power consumption assumes a maximum load including the mounting of option boards. The wattage given does not include the mounting of any option boards. Therefore, be sure to take into account any additional wattage that may result form the use of option boards during actual operation.

5.2 NWP (Peripheral) Series Maximum Power Consumption

NWP Series Maximum Power Consumption (1/2)

Model	For J [100V]	For UC [120V]	For EK [220V]	Remarks
NWP-413 for Standard VME Board	2.5A 200W	—	—	Theoretical value
NWP-414 VME Box	2.5A 200W	—	—	Theoretical value
NWP-511F 14″ Kanji Terminal	0.6A 37W	—	—	
NWP-512D 15″ Monochrome Display	1.17A 63W	1.04A 63W	0.56A 60W	
NWP-514 17″ Color Display	2.20A 128W	1.95A 128W	1.17A 125W	
NWP-514 19″ Monochrome Display	1.28A 75W	1.10A 75W	0.52A 65W	
NWP-515 14″ Color Display	1.3A 100W	—	0.65A 100W	
NWP-516 20″ Color Display	2.42A 73W	2.18A 73W	1.38A 73W	
NWP-517 X Terminal	2A 50W	—	—	
NWP-518 17″ Monochrome Display	1.2A 80W	—	—	
NWP-519 17″ Color Display	2.4A 150W	—	1.3A 150W	
NWE-501 19″ Monocrhome Display	—	1.10A 75W	—	
NWU-350 20″ Grayscale Display	—	1.5A 126W	0.8A 123W	
NWP-5001 VECTRON	3.20A 300W	—	—	
NWP-533 A4 Size Laser Beam Printer	7A 700W	—	—	catalog value
NWP-537 B4/A4 Size Laser Beam Printer	8A 800W	—	—	catalog value
NWP-543 A3 Size Laser Beam Printer	15A 900W	—	—	
NWP-549 Color Printer	5A 150W	—	—	
NWE-101*1 A4 Size Laser Beam Printer	—	—	6A 900W	Data obtained by Sony Microsystems Europe.
NWP-534 Image Reader A4	2A 120W	—	—	catalog value
NWP-540 Image Reader A4	2A 120W	—	—	catalog value
NWP-544 Image Reader A3	—	—	—	
NWP-548 Color Image Reader A4	1A 40W	1A 40W	0.5A 40W	
NWE-105* Image Reader	—	—	1A 120W	Data obtained by Sony Microsystems Europe.
NWP-532 Hard Disk Unit	0.6A 35W	—	—	
NWP-535 Expansion H/D 286MB	0.6A 35W	—	—	
NWP-535A Hard Disk Unit	—	—	0.4A 40W	

*NWE-101/105 are available only in Europe.

Model	For J [100V]	For UC [120V]	For EK [220V]	Remarks
NWP-545 Expansion H/D 640 MB	0.6A 32W	0.5A 33W	—	
NWP-547 Expansion H/D 240MB	0.6A 30W	—	0.3A 30W	
NWP-559 Hard Disk (Horizontal)	0.6A 35W	0.55A 35W	0.3A 35W	
NWP-531 Streaming Tape Unit	0.45A 25W	—	—	
NWP-536 Streaming Tape Unit	0.45A 25W	—	—	
NWP-536A Streaming Tape Unit	—	—	0.35A 37W	
NWP-546 Streaming Tape Unit	0.45A 20W	—	—	
NWP-539N MO Disk Unit	0.6A 35W	—	—	0.9A, 65W during operation
NWP-541 CD-Rom Drive	—	—	—	
NWP-542 DAT Data Storage Unit	0.36A 21W	0.36A 23W	—	

The value described in this table indicates an actually measured value unless otherwise specified.

NWP Series Maximum Power Consumption (2/2)

Model		+5V	+12V	−12V	Remarks
NWP-410	Thumb Shift Keyboard	154mA	—	—	
NWP-411	Keyboard	164mA	—	—	
NWP-411A	Keyboard	135mA	—	—	

The value described in this table indicates an actually measured value unless otherwise specified.

5.3 NWB (Board) Series Maximum Power Consumption

NWB Series Maximum Power Consumption

Model		+5V	+12V	−12V	Remarks
NWB-108	8 MB Expansion RAM Board	1.3A	—	—	
NWB-109	16 MB Expansion RAM Board	0.8A	—	—	1.0A during memory check
NWB-110	Expansion RAM Board	0.8A	—	—	1.0A during memory check
NWB-112	64MB Expansion RAM Board	3A	—	—	
NWB-112A	64MB Expansion RAM Board	3A	—	—	
NWB-225A	Color Bitmap Interface	4.4A	—	—	
NWB-251	Color Bitmap Interface	5.5A	—	—	
NWB-252	Color Bitmap Interface	2A	—	—	
NWB-253	Color Bitmap Interface	2A	50mA	—	
NWB-254/254P	Videomap Display Interface	4.5A	0.5A	—	
NWB-280	4 Plane Color Expansion	1.4A	—	—	
NWB-255	Monochrome Bitmap Interface	1A	50mA	—	
NWB-512	Monochrome Bitmap Interface	2.9A	96mA	—	
NWB-518	Monochrome Bitmap Interface	2.5A	50mA	—	
NWB-514	Grayscale Bitmap Interface	3.8A	38mA	—	
NWB-224/224P	Full Color Video Graphic Interface	6.5A	1A	1A	
NWB-226	VTR Control Interface	1.2A	—	—	
NWB-234A	VME Interface	2.14A (I/O Board) 2.08A (VME Board)	—	—	
NWB-240A	L.B.P./Image Reader Interface	1.6A	—	—	
NWB-241A	L.B.P./Image Reader Interface	2.6A	—	—	
NWB-242	Image Board	3.8A	—	—	
NWB-243	Image Board	4.5A	—	—	
NWB-231A	4 Channel Serial Interface	0.94A	52mA	81mA	
NWB-232A	GP-IB Interface	1.3A	35mA	48mA	
NWB-235A	Expansion Network	1.2A	100mA	—	
NWB-238	Modem Board for NWS-1200	0.2A	—	0.1A	
NWB-260	Audio Interface Board	1.9A	155mA	110mA	

The value described in this table indicates an actually measured value unless otherwise specified.

Chapter

6

NEWS Series Performance

Measured performance data for the various NEWS Series is given below.

The following benchmark test programs were used:

- Dhrystone 1.1
- Whetstone
- Khornerstone
- Linpack
- Livermore Fortran Kernels

The results shown in this chapter are provided for internal office use only.

Contents

6.1 Preface

Performance data for NEWS Series system units is given in this chapter. The following test conditions were observed:

1 BENCHMARK PROGRAMS used

(1) Dhrystone 1.1 (DHRY 1.1)

(2) Whetstone

(3) Khornerstone

(4) Linpack (LNPK DP and LNPK SP)

(5) Livermore Fortran Kernels (LLNL DP and LLNL SP)

2 CONDITIONS

- OS used

  NEWS-OS Release 4.0C & 4.0R (Unix 4.3 BSD based)
- All tests were run in single user mode.
- The optimization level used for RISC machines was three.
- NWS-1860 with main memory of 32MB and NWS-3870 with main memory of 128MB were used as the server for diskless machines NWS-711 and NWS-721.
- For diskless machines, a local network environment is used: only the server and a testing client machine are connected to the network.

[NOTE]

The results printed in the following tables in this chapter are actually measured values. The results contains some uncertainties and may not be the best values.

3 RESULTS HANDLINGS

(1) Dhryston 1.1

Unit: Dhrystone/sec

Mips (Millions of instructions per second)

The MIPS value is determined in comparison with the performance of VAX 11/780 measured using the Dhrystone program. VAX is a registerd trademark of Digital Equipment Corporation.

(2) Whetstone

Unit: Mwhet/sec (Mega whetstone per second)

Test is done in both double and single precisions.

(3) Khornerstone

Unit: khorners/sec

Test is done using type, with 10 looping counter.

Note that no data adjustments have made to the results. When you read the data you cannot simply compare the total khornerstone values. Speical attentions must be made especially for the test results of Reading 256 kb/16 kb sequentially. The results of each tests contain more than 10% of uncertainty.

Concerning the Disck Cache

The disk cache found in NEWS workstations is originally a feature of the UNIX operating system and is used to reduce the number of times the hard disk needs to be accessed.

This accomplished by temporarily storing any data read from or written to the hard disk within part of the main memory used by the kernel. If the same data is required at a later time it can be retrieved without accessing the disk.

However, the important point to be made here is that when data is written to a file, although it is written to both the disk cache and the disk, the OS does not make you wait for the disk write to end before allowing you to access the data again.

In the original UNIX 4.2/4.3 BSD versions, this disk cache was usually fixed at a level of about 5% to 10% of the total main memory. However, beginning with NEWS-OS 3.4, dynamic allocation of large portions of the main memory as disk cache is possible. This will be referred to as a "dynamic buffer."

With the dynamic buffer, it is possible to use as much as 2 to 3 Mbytes of memory as disk cache for a 4-Mbyte machine, and as much as 12 to 14 Mbytes for a 16-Mbyte machine. This means that even files larger than 10 Mbytes in size can be temporarily stored in the disk cache of a 16-Mbyte machine. The size of this dynamic buffer happens to effect disk access times as measured by the Khornerstone test.

Effects of disk cache on the Khornerstone disk access test

When using a 4-Mbyte (8-Mbyte) machine

1. Building a 8-Mbyte file test

   Data is stored while allocating memory as disk cache. Simultaneous disk write begins. Since 8 Mbytes of disk cache cannot be allocated, time is required in waiting to reuse portions of the disk cache containing data already written to the disk. For this reason, there is some time required in waiting for disk access to end.

*Actually the disk cache has many other uses which will not be covered here.

2. Reading 8 Mbytes randomly

   If the data is in the disk cache, it is transferred from there. Otherwise, it is read from the disk and then stored in the disk cache. As in 1 above, 8 Mbytes of memory cannot be allocated, so the data must be written to portions of the disk cache containing data already read out. Again, there is some time required in waiting for disk access to end.

3. Reading 8 Mbytes sequentially

   If the data is in the disk cache it is transferred from there. Otherwise, it is read from the disk and then stored in the disk cache. As in 1 above, 8 Mbytes of memory cannot be allocated, so the data must be written to portions of the disk cache containing data already read out. Again, there is some time required in waiting for disk access to end. The last part of the file remains in the disk cache.

4. Reading 1 Mbyte sequentially

   Since the data is not in the disk cache, it is read from the disk and then stored in the disk cache. The entire 1 Mbyte of data remains in the disk cache in this case.

5. Reading 256 Kbytes sequentially
6. Reading 16 Kbytes sequentially

   Data is transferred from the disk cache. There is no disk access made in this case.

When using an 8-Mbyte (32-Mbyte) machine

1. Building an 8-Mbyte file test

   Data is stored while allocating memory as disk cache. Simultaneous disk write begins. No time is required in waiting for the disk write to end. All data remains in the disk cache.

2. Reading 8 Mbytes randomly

   Although data is in the disk cache, time is required in waiting for the disk write in 1 above to end if it hasn't already. For this reason, there may be some time required in waiting for disk access to end. All data remains in the disk cache.

3. Reading 8 Mbytes sequentially

   Since the disk write in 2 above has already ended, data only needs to be transferred from the disk cache.

4. Reading 1 Mbytes sequentially
5. Reading 256 Kbytes sequentially
6. Reading 16 Kbytes sequentially

   Data is transferred from the disk cache. There is no disk access made in this case.

For example, as can be seen in the figures below for the 8-Mbyte NWS-1750 workstation,

Building an 8-Mbyte file test	5.790 seconds	949.91 khorners
Reading 8 Mbytes randomly	129.980 seconds	215.42 khorners
Reading 8 Mbytes sequentially	16.900 seconds	189.35 khorners
Reading 1 Mbyte sequentially	2.910 seconds	154.64 khorners
Reading 256 Kbytes sequentially	0.140 seconds	857.14 khorners
Reading 16 Kbytes sequentially	0.100 seconds	200.00 khorners

an abnormally long period of time is required in reading 8 Mbytes randomly.

With 16 Mbytes available in the same NWS-1750, the decrease in this time is dramatic as shown below.

Building an 8-Mbyte file test	5.470 seconds	1005.48 khorners
Reading 8 Mbytes randomly	7.630 seconds	3669.72 khorners
Reading 8 Mbytes sequentially	3.070 seconds	1042.35 khorners
Reading 1 Mbyte sequentially	0.410 seconds	1097.56 khorners
Reading 256 Kbytes sequentially	0.110 seconds	1090.91 khorners
Reading 16 Kbytes sequentially	0.010 seconds	2000.00 khorners

The time required for the sequential read/write of an 8-Mbyte file should be between 10 to 15 seconds in consideration of the disk transfer rate. However, due to the effects of a smaller cache memory size on the Khornerstone test, once the disk write begins for building an 8-Mbyte file, the 8-Mbyte random read appears to take about seven seconds longer than expected.

Since both the 256-Kbyte and 16-Kbyte sequential reads are transferred internally within main memory, the times recorded are extremely short. (Beyond the measuring capacity of the clock used.)

[NOTE]

Measurable time is a hundredth of a second. Results obtained in a short period of time are greatly affected by the uncertainty contained in measuring time. Therefore, the obtained results may not be trustable. Especially, if time required for test program to run is less than a hundredth of a second, the result will be zero. This is due to the lack of accuracy of the timer, and is not an error.

<Example> NWS-3870 128MB

Read 16 Kb sequentially: 0.000 seconds 0.00 khorners

(4) Linpack

Unit: MFlops (Millions of Floating point operations per second)

Following Dongarra's report (Dongarra, J., "Performance of Various Computers Using Standard Linear Equations in a Fortran Environment', Argonne National Laboratory, February 12. 1989.), In CISC NEWS workstations we use the highest MFlops number that appears in leading dimension 201 results, and then rounded to three digits. In RISC NEWS workstations, however, we use the highest MFlops number that appears in leading dimension 100 results, and then rounded to three digits.

(5) Livermore Fotran Kernels

Unit: Mflops (Millions of Floating point operations per second)

Only Geometric means of span size 167 is reported in both single and double precision. If other data such as Max Rate, Min Rate, Harm Mean etc. in span size of 19, 90, 471 are needed, those data may also be available.

4 CONFIGURATIONS

NWS-711	CPU	MC68020 (16.67MHz)
	Floating-Point Coprocessor	MC68881 (16.67MHz)
	IOP	none
	Main Memory	4MB
	Cache Memory	none
	Hard Disk	none
	Operating System	NEWS OS Release 4.0C
NWS-721	CPU	MC68020 (20MHz)
	Floating-Point Coprocessor	MC68881 (20MHz)
	IOP	none
	Main Memory	8MB
	Cache Memory	none
	Hard Disk	none
	Operating System	NEWS OS Release 4.0C
NWS-821	CPU	MC68020 (16.67MHz)
	Floating-Point Coprocessor	MC68881 (16.67MHz)
	IOP	MC68020 (16.67MHz)
	Main Memory	4MB
	Cache Memory	none
	Hard Disk	156 MB
	Operating System	NEWS OS Release 4.0C
NWS-841	CPU	MC68020 (16.67MHz)
	Floating-Point Coprocessor	MC68881 (16.67MHz)
	IOP	MC68020 (16.67MHz)
	Main Memory	4/8/16MB
	Cache Memory	8KB
	Hard Disk	286MB
	Operating System	NEWS OS Release 4.0C
NWS-891	CPU	MC68020 (16.67MHz)
	Floating-Point Coprocessor	MC68881 (16.67MHz)
	IOP	MC68020 (16.67MHz)
	Main Memory	4MB
	Cache Memory	none
	Hard Disk	86MB
	Operating System	NEWS-OS Release 4.0C
NWS-921	CPU	MC68020 (16.67MHz)
	Floating-Point Coprocessor	MC68882 (20MHz)
	IOP	MC68020 (16.67MHz)
	Main Memory	8MB
	Cache Memory	8KB
	Hard Disk	286MB × 4
	Operating System	NEWS OS Release 4.0C
NWS-1230	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	none
	Main Memory	4/8/12MB
	Cache Memory	none
	Hard Disk	200MB
	Operating System	NEWS-OS Release 4.0C
NWS-1250	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	none
	Main Memory	8/12MB
	Cache Memory	none
	Hard Disk	240MB
	Operating System	NEWS-OS Release 4.0C

NWS-1450	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	none
	Main Memory	8/16MB
	Cache Memory	none
	Hard Disk	240MB
	Operating System	NEWS-OS Release 4.0C
NWS-1460	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882(25 MHz)
	IOP	none
	Main Memory	8/16MB
	Cache Memory	none
	Hard Disk	240MB
	Operating System	NEWS OS Release 4.0C
PWS-1560	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68881 (25MHz)
	IOP	none
	Main Memory	4/8/16MB
	Cache Memory	none
	Hard Disk	91MB
	Operating System	NEWS OS Release 4.0C
NWS-1750	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	none
	Main Memory	4/8/16MB
	Cache Memory	16KB
	Hard Disk	286MB
	Operating System	NEWS OS Release 4.0C
NWS-1850	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	MC68030 (25MHz)
	Main Memory	16/32MB
	Cache Memory	64KB
	Hard Disk	286MB
	Operating System	NEWS OS Release 4.0C
NWS-1860	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	MC68030 (25MHz)
	Main Memory	16/32MB
	Cache Memory	64KB
	Hard Disk	640MB
	Operating System	NEWS-OS Release 4.0C
NWS-1960	CPU	MC68030 (25MHz)
	Floating-Point Coprocessor	MC68882 (25MHz)
	IOP	MC68030 (25MHz)
	Main Memory	16/32MB
	Cache Memory	64KB
	Hard Disk	286MB × 3
	Operating System	NEWS-OS Release 4.0C
NWS-3260	CPU	R3000 (20MHz)
	Floating-Point Coprocessor	R3010 (20MHz)
	IOP	none
	Main Memory	16/32/48MB
	Cache Memory	icache 32KB + dcache 32KB
	Hard Disk	406 MB
	Operating System	NEWS-OS Release 4.0R

NWS-3460	CPU	R3000 (20MHz)
	Floating-Point Coprocessor	R3010 (20MHz)
	IOP	none
	Main Memory	8/16MB
	Cache Memory	icache 64KB + dcache 64KB
	Hard Disk	415MB
	Operating System	NEWS-OS Release 4.0R
NWS-3720	CPU	R3000 (20MHz)
	Floating-Point Coprocessor	R3010 (20MHz)
	IOP	none
	Main Memory	16MB
	Cache Memory	icache 64KB + dcache 64KB
	Hard Disk	640MB
	Operating System	NEWS-OS Release 4.0R
NWS-3840	CPU	R3000 (20MHz)
	Floating-Point Coprocessor	R3010 (20MHz)
	IOP	MC68030 (20MHz)
	Main Memory	16MB
	Cache Memory	icache 64KB + dcache 64KB
	Hard Disk	286MB
	Operating System	NEWS-OS Release 4.0R
NWS-3860	CPU	R3000 (20MHz)
	Floating-Point Coprocessor	R3010 (20MHz)
	IOP	MC68030 (20MHz)
	Main Memory	16MB
	Cache Memory	icache 64KB + dcache 64KB
	Hard Disk	640MB
	Operating System	NEWS-OS Release 4.0R
NWS-3870	CPU	R3000 (20MHz)
	Floating-Point Coprocessor	R3010 (20MHz)
	IOP	MC68030 (20MHz)
	Main Memory	64/128MB
	Cache Memory	icache 64KB + dcache 64KB
	Hard Disk	1280MB
	Operating System	NEWS-OS Release 4.0R

6.2 Data of Dhrystone 1.1 Benchmark Test

table 6.2-1 results

Dhrystone 1.1		
	(Dhrystone/sec)	(Mips)
NWS-711(CISC)	3326	1.90
NWS-711(RISC)	3326	1.90
NWS-721(CISC)	4688	2.68
NWS-721(RISC)	4688	2.68
NWS-821	3855	2.20
NWS-841	4191	2.39
NWS-891	3841	2.19
NWS-921	4172	2.38
NWS-1230	6326	3.61
NWS-1250	6326	3.61
NWS-1450	6272	3.58
NWS-1460	6270	3.58
PWS-1560	6270	3.58
NWS-1750	6942	3.97
NWS-1850	8675	4.96
NWS-1860	8680	4.96
NWS-1960	8680	4.96
NWS-3260	29568	16.90
NWS-3460	29621	16.93
NWS-3720	29603	16.92
NWS-3840	34153	19.52
NWS-3860	34153	19.52
NWS-3870	42699	24.40

[Note] Machine names followed by ( ), indicate diskless machines.
For (CISC), use an NWS-1860 with main memory of 32MB as a server machine.
For (RISC), use an NWS-3870 with main memory of 128MB as a server machine.

The results obtained here are actually measured values and contain some uncertainty.
These values may not be the best values.

6.3 Data of Whetstone Benchmark Test

table 6.3-1 results

Whetstone		
	Whetstone-double (Mwhet/sec)	Whetstone-single (Mwhet/sec)
NWS-711(CISC)	0.838	0.936
NWS-711(RISC)	0.838	0.936
NWS-721(CISC)	1.046	1.158
NWS-721(RISC)	1.046	1.158
NWS-821	0.865	0.958
NWS-841	0.870	0.959
NWS-891	0.864	0.957
NWS-921	1.156	1.315
NWS-1230	1.656	1.866
NWS-1250	1.655	1.866
NWS-1450	1.652	1.861
NWS-1460	1.652	1.862
PWS-1560	1.307	1.458
NWS-1750	1.691	1.866
NWS-1850	1.753	1.911
NWS-1860	1.753	1.911
NWS-1960	1.753	1.910
NWS-3260	10.627	13.967
NWS-3460	10.627	14.006
NWS-3720	10.627	13.967
NWS-3840	11.038	14.025
NWS-3860	11.050	14.006
NWS-3870	13.793	17.544

[Note] Machine names followed by ( ), indicate diskless machines.
For (CISC), use an NWS-1860 with main memory of 32MB as a server machine.
For (RISC), use an NWS-3870 with main memory of 128MB as a server machine.

6.4 Data of Khornerstone Benchmark Test

table 6.4-1 results

Khornerstone		
	main memory (MByte)	Khornerstone (khorners)
NWS-711(CISC)	4	3865.15
NWS-711(RISC)	4	4050.15
NWS-721(CISC)	8	4617.54
NWS-721(RISC)	8	4844.41
NWS-821	4	4615.74
NWS-841	8	4835.59
NWS-891	4	4731.12
NWS-921	8	5120.63
NWS-1230	4	6302.12
	8	9097.93
	12	12529.69
NWS-1250	8	9130.21
	12	12436.03
NWS-1450	8	8756.10
	16	12669.72
NWS-1460	8	8766.77
	16	12794.67
PWS-1560	4	5684.95
	8	12443.41
	16	12435.92
NWS-1750	4	6281.68
	8	7061.04
	16	15010.51
NWS-1850	16	19327.50*
	32	17894.70
NWS-1860	16	29827.48
	32	29987.95
NWS-1960	16	26586.22*
	32	22420.85
NWS-3260	16	44412.00
	32	41541.38
	48	42202.92
NWS-3460	8	32266.19
	16	37573.81*
NWS-3720	16	54165.35
NWS-3840	16	57507.57
NWS-3860	16	56886.84
NWS-3870	64	65339.12*
	128	63756.11*

* Result does not reflect the actual machine performance. See individual khornerstone values for each subtest.

[Note] Machine names followed by ( ), indicate diskless machines.
For (CISC), use an NWS-1860 with main memory of 32MB as a server machine.
For (RISC), use an NWS-3870 with main memory of 128MB as a server machine.

table 6.4-2 results [NWS-711 4MB (CISC)]

System: generic
Repetitions Count: 10

NWS-711 4MB (CISC)		
C sort of real numbers	308.420 seconds	92.41 khorners
C sort of integers	166.560 seconds	93.06 khorners
Fortran Sieve test	1.130 seconds	132.74 khorners
Fortran Sieve test	1.130 seconds	132.74 khorners
Fortran Sieve test	1.140 seconds	131.58 khorners
Fortran Whetstone test	14.130 seconds	84.93 khorners
Fortran Whetstone test	14.150 seconds	84.81 khorners
Fortran Whetstone test	14.140 seconds	84.87 khorners
C Fib. test	45.050 seconds	95.45 khorners
C Whetstone SP test	13.110 seconds	114.42 khorners
C Whetstone DP test	12.100 seconds	107.44 khorners
C Sieve test	121.060 seconds	90.86 khorners
C ackerman test	99.260 seconds	90.67 khorners
Build 8 Mb file test	86.020 seconds	63.94 khorners
Read 8 Mb randomly	97.720 seconds	286.53 khorners
Read 8 Mb sequentially	23.130 seconds	138.35 khorners
Read 1 Mb sequentially	3.270 seconds	137.61 khorners
Read 256 Kb sequentially	0.250 seconds	480.00 khorners
Read 16 Kb sequentially	0.110 seconds	181.82 khorners
Dhrystone test	17.820 seconds	95.40 khorners
C Savage test	18.620 seconds	150.38 khorners
Total time for execution	1085.260 seconds	995.15 khorners

Total Khornerstones = 3865.148 khorners

table 6.4-3 results [NWS-711 4MB (RISC)]

System: generic
Repetitions Count: 10

NWS-711 4MB (RISC)		
C sort of real numbers	308.430 seconds	92.40 khorners
C sort of integers	166.520 seconds	93.08 khorners
Fortran Sieve test	1.120 seconds	133.93 khorners
Fortran Sieve test	1.120 seconds	133.93 khorners
Fortran Sieve test	1.130 seconds	132.74 khorners
Fortran Whetstone test	14.130 seconds	84.93 khorners
Fortran Whetstone test	14.140 seconds	84.87 khorners
Fortran Whetstone test	14.130 seconds	84.93 khorners
C Fib. test	45.010 seconds	95.53 khorners
C Whetstone SP test	13.110 seconds	114.42 khorners
C Whetstone DP test	12.100 seconds	107.44 khorners
C Sieve test	121.010 seconds	90.90 khorners
C ackerman test	99.220 seconds	90.71 khorners
Build 8 Mb file test	74.480 seconds	73.85 khorners
Read 8 Mb randomly	89.580 seconds	312.57 khorners
Read 8 Mb sequentially	21.630 seconds	147.94 khorners
Read 1 Mb sequentially	2.840 seconds	158.45 khorners
Read 256 Kb sequentially	0.210 seconds	571.43 khorners
Read 16 Kb sequentially	0.110 seconds	181.82 khorners
Dhrystone test	17.820 seconds	95.40 khorners
C Savage test	18.600 seconds	150.54 khorners
Total time for execution	1060.530 seconds	1018.36 khorners

Total Khornerstones = 4050.150 khorners

table 6.4-4 results [NWS-721 8MB (CISC)]

System: generic
Repetitions Count: 10

NWS-721 8MB (CISC)		
C sort of real numbers	241.160 seconds	118.18 khorners
C sort of integers	122.910 seconds	126.11 khorners
Fortran Sieve test	1.220 seconds	122.95 khorners
Fortran Sieve test	1.230 seconds	121.95 khorners
Fortran Sieve test	1.240 seconds	120.97 khorners
Fortran Whetstone test	11.440 seconds	104.90 khorners
Fortran Whetstone test	11.440 seconds	104.90 khorners
Fortran Whetstone test	11.440 seconds	104.90 khorners
C Fib. test	33.740 seconds	127.45 khorners
C Whetstone SP test	10.600 seconds	141.51 khorners
C Whetstone DP test	9.710 seconds	133.88 khorners
C Sieve test	91.910 seconds	119.68 khorners
C ackerman test	74.110 seconds	121.44 khorners
Build 8 Mb file test	78.350 seconds	70.20 khorners
Read 8 Mb randomly	101.150 seconds	276.82 khorners
Read 8 Mb sequentially	18.980 seconds	168.60 khorners
Read 1 Mb sequentially	2.500 seconds	180.00 khorners
Read 256 Kb sequentially	0.200 seconds	600.00 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	12.710 seconds	133.75 khorners
C Savage test	15.280 seconds	183.25 khorners
Total time for execution	873.700 seconds	1236.12 khorners

Total Khornerstones = 4617.537 khorners

table 6.4-5 results [NWS-721 8MB (RISC)]

System: generic
Repetitions Count: 10

NWS-721 8MB (RISC)		
C sort of real numbers	241.120 seconds	118.20 khorners
C sort of integers	122.910 seconds	126.11 khorners
Fortran Sieve test	1.240 seconds	120.97 khorners
Fortran Sieve test	1.230 seconds	121.95 khorners
Fortran Sieve test	1.240 seconds	120.97 khorners
Fortran Whetstone test	11.390 seconds	105.36 khorners
Fortran Whetstone test	11.390 seconds	105.36 khorners
Fortran Whetstone test	11.390 seconds	105.36 khorners
C Fib. test	33.710 seconds	127.56 khorners
C Whetstone SP test	10.600 seconds	141.51 khorners
C Whetstone DP test	9.710 seconds	133.88 khorners
C Sieve test	91.830 seconds	119.79 khorners
C ackerman test	74.050 seconds	121.54 khorners
Build 8 Mb file test	65.760 seconds	83.64 khorners
Read 8 Mb randomly	92.140 seconds	303.89 khorners
Read 8 Mb sequentially	17.290 seconds	185.08 khorners
Read 1 Mb sequentially	2.310 seconds	194.81 khorners
Read 256 Kb sequentially	0.180 seconds	666.67 khorners
Read 16 Kb sequentially	0.080 seconds	250.00 khorners
Dhrystone test	12.710 seconds	133.75 khorners
C Savage test	15.210 seconds	184.09 khorners
Total time for execution	847.750 seconds	1273.96 khorners

Total Khornerstones = 4844.413 khorners

table 6.4-6 results [NWS-821 4MB]

System: generic
Repetitions Count: 10

NWS-821 4MB		
C sort of real numbers	291.720 seconds	97.70 khorners
C sort of integers	149.740 seconds	103.51 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Whetstone test	13.430 seconds	89.35 khorners
Fortran Whetstone test	13.430 seconds	89.35 khorners
Fortran Whetstone test	13.420 seconds	89.42 khorners
C Fib. test	40.770 seconds	105.47 khorners
C Whetstone SP test	12.810 seconds	117.10 khorners
C Whetstone DP test	11.720 seconds	110.92 khorners
C Sieve test	111.340 seconds	98.80 khorners
C ackerman test	89.520 seconds	100.54 khorners
Build 8 Mb file test	16.640 seconds	330.53 khorners
Read 8 Mb randomly	199.970 seconds	140.02 khorners
Read 8 Mb sequentially	33.870 seconds	94.48 khorners
Read 1 Mb sequentially	4.430 seconds	101.58 khorners
Read 256 Kb sequentially	0.210 seconds	571.43 khorners
Read 16 Kb sequentially	0.090 seconds	222.22 khorners
Dhrystone test	15.210 seconds	111.77 khorners
C Savage test	18.310 seconds	152.92 khorners
Total time for execution	1055.460 seconds	1023.25 khorners

Total Khornerstones = 4615.738 khorners

table 6.4-7 results [NWS-841 8MB]

System: generic
Repetitions Count: 10

NWS-841 8MB		
C sort of real numbers	291.310 seconds	97.83 khorners
C sort of integers	149.510 seconds	103.67 khorners
Fortran Sieve test	0.500 seconds	300.00 khorners
Fortran Sieve test	0.500 seconds	300.00 khorners
Fortran Sieve test	0.500 seconds	300.00 khorners
Fortran Whetstone test	13.200 seconds	90.91 khorners
Fortran Whetstone test	13.200 seconds	90.91 khorners
Fortran Whetstone test	13.200 seconds	90.91 khorners
C Fib. test	40.700 seconds	105.65 khorners
C Whetstone SP test	12.800 seconds	117.19 khorners
C Whetstone DP test	11.700 seconds	111.11 khorners
C Sieve test	111.210 seconds	98.91 khorners
C ackerman test	89.400 seconds	100.67 khorners
Build 8 Mb file test	12.130 seconds	453.42 khorners
Read 8 Mb randomly	262.240 seconds	106.77 khorners
Read 8 Mb sequentially	19.140 seconds	167.19 khorners
Read 1 Mb sequentially	2.720 seconds	165.44 khorners
Read 256 Kb sequentially	0.210 seconds	571.43 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	14.010 seconds	121.34 khorners
C Savage test	18.210 seconds	153.76 khorners
Total time for execution	1092.600 seconds	988.47 khorners

Total Khornerstones = 4835.590 khorners

table 6.4-8 results [NWS-891 4MB]

System: generic
Repetitions Count: 10

NWS-891 4MB		
C sort of real numbers	291.890 seconds	97.64 khorners
C sort of integers	149.840 seconds	103.44 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Whetstone test	13.420 seconds	89.42 khorners
Fortran Whetstone test	13.430 seconds	89.35 khorners
Fortran Whetstone test	13.450 seconds	89.22 khorners
C Fib. test	40.810 seconds	105.37 khorners
C Whetstone SP test	12.810 seconds	117.10 khorners
C Whetstone DP test	11.710 seconds	111.02 khorners
C Sieve test	111.420 seconds	98.73 khorners
C ackerman test	89.520 seconds	100.54 khorners
Build 8 Mb file test	16.660 seconds	330.13 khorners
Read 8 Mb randomly	211.800 seconds	132.20 khorners
Read 8 Mb sequentially	34.330 seconds	93.21 khorners
Read 1 Mb sequentially	4.490 seconds	100.22 khorners
Read 256 Kb sequentially	0.200 seconds	600.00 khorners
Read 16 Kb sequentially	0.060 seconds	333.33 khorners
Dhrystone test	15.310 seconds	111.04 khorners
C Savage test	18.310 seconds	152.92 khorners
Total time for execution	1068.400 seconds	1010.86 khorners

Total Khornerstones = 4731.117 khorners

table 6.4-9 results [NWS-921 8MB]

System: generic
Repetitions Count: 10

NWS-921 8MB		
C sort of real numbers	275.520 seconds	103.44 khorners
C sort of integers	149.600 seconds	103.61 khorners
Fortran Sieve test	0.510 seconds	294.12 khorners
Fortran Sieve test	0.520 seconds	288.46 khorners
Fortran Sieve test	0.510 seconds	294.12 khorners
Fortran Whetstone test	9.720 seconds	123.46 khorners
Fortran Whetstone test	9.720 seconds	123.46 khorners
Fortran Whetstone test	9.720 seconds	123.46 khorners
C Fib. test	40.720 seconds	105.60 khorners
C Whetstone SP test	9.110 seconds	164.65 khorners
C Whetstone DP test	8.790 seconds	147.90 khorners
C Sieve test	111.230 seconds	98.89 khorners
C ackerman test	89.420 seconds	100.65 khorners
Build 8 Mb file test	12.130 seconds	453.42 khorners
Read 8 Mb randomly	232.050 seconds	120.66 khorners
Read 8 Mb sequentially	19.050 seconds	167.98 khorners
Read 1 Mb sequentially	2.730 seconds	164.84 khorners
Read 256 Kb sequentially	0.210 seconds	571.43 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	14.100 seconds	120.57 khorners
C Savage test	14.210 seconds	197.04 khorners
Total time for execution	1025.760 seconds	1052.88 khorners

Total Khornerstones = 5120.627 khorners

table 6.4-10 results [NWS-1230 4MB]

System: generic
Repetitions Count: 10

NWS-1230 4MB		
C sort of real numbers	164.590 seconds	173.16 khorners
C sort of integers	82.000 seconds	189.02 khorners
Fortran Sieve test	0.790 seconds	189.87 khorners
Fortran Sieve test	0.740 seconds	202.70 khorners
Fortran Sieve test	0.720 seconds	208.33 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
C Fib. test	22.580 seconds	190.43 khorners
C Whetstone SP test	6.390 seconds	234.74 khorners
C Whetstone DP test	6.100 seconds	213.11 khorners
C Sieve test	61.100 seconds	180.03 khorners
C ackerman test	46.690 seconds	192.76 khorners
Build 8 Mb file test	9.780 seconds	562.37 khorners
Read 8 Mb randomly	182.320 seconds	153.58 khorners
Read 8 Mb sequentially	28.840 seconds	110.96 khorners
Read 1 Mb sequentially	3.800 seconds	118.42 khorners
Read 256 Kb sequentially	0.190 seconds	631.58 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	9.290 seconds	182.99 khorners
C Savage test	11.000 seconds	254.55 khorners
Total time for execution	671.790 seconds	1607.65 khorners

Total Khornerstones = 6302.119 khorners

table 6.4-11 results [NWS-1230 8MB]

System: generic
Repetitions Count: 10

NWS-1230 8MB		
C sort of real numbers	164.520 seconds	173.23 khorners
C sort of integers	82.000 seconds	189.02 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
C Fib. test	22.590 seconds	190.35 khorners
C Whetstone SP test	6.390 seconds	234.74 khorners
C Whetstone DP test	6.110 seconds	212.77 khorners
C Sieve test	61.110 seconds	180.00 khorners
C ackerman test	53.210 seconds	169.14 khorners
Build 8 Mb file test	7.050 seconds	780.14 khorners
Read 8 Mb randomly	162.420 seconds	172.39 khorners
Read 8 Mb sequentially	13.690 seconds	233.75 khorners
Read 1 Mb sequentially	2.210 seconds	203.62 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.210 seconds	184.58 khorners
C Savage test	10.980 seconds	255.01 khorners
Total time for execution	639.760 seconds	1688.13 khorners

Total Khornerstones = 9097.925 khorners

table 6.4-12 results [NWS-1230 12MB]

System: generic
Repetitions Count: 10

NWS-1230 12MB		
C sort of real numbers	164.550 seconds	173.20 khorners
C sort of integers	82.000 seconds	189.02 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Whetstone test	7.150 seconds	167.83 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
C Fib. test	22.600 seconds	190.27 khorners
C Whetstone SP test	6.400 seconds	234.37 khorners
C Whetstone DP test	6.110 seconds	212.77 khorners
C Sieve test	61.100 seconds	180.03 khorners
C ackerman test	48.580 seconds	185.26 khorners
Build 8 Mb file test	7.660 seconds	718.02 khorners
Read 8 Mb randomly	15.740 seconds	1778.91 khorners
Read 8 Mb sequentially	3.940 seconds	812.18 khorners
Read 1 Mb sequentially	0.500 seconds	900.00 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.210 seconds	184.58 khorners
C Savage test	10.990 seconds	254.78 khorners
Total time for execution	472.350 seconds	2286.44 khorners

Total Khornerstones = 12529.689 khorners

table 6.4-13 results [NWS-1250 8MB]

System: generic
Repetitions Count: 10

NWS-1250 8MB		
C sort of real numbers	164.500 seconds	173.25 khorners
C sort of integers	81.950 seconds	189.14 khorners
Fortran Sieve test	0.700 seconds	214.29 khorners
Fortran Sieve test	0.700 seconds	214.29 khorners
Fortran Sieve test	0.700 seconds	214.29 khorners
Fortran Whetstone test	7.100 seconds	169.01 khorners
Fortran Whetstone test	7.100 seconds	169.01 khorners
Fortran Whetstone test	7.100 seconds	169.01 khorners
C Fib. test	22.570 seconds	190.52 khorners
C Whetstone SP test	6.390 seconds	234.74 khorners
C Whetstone DP test	6.120 seconds	212.42 khorners
C Sieve test	61.100 seconds	180.03 khorners
C ackerman test	51.100 seconds	176.13 khorners
Build 8 Mb file test	7.120 seconds	772.47 khorners
Read 8 Mb randomly	163.360 seconds	171.40 khorners
Read 8 Mb sequentially	13.750 seconds	232.73 khorners
Read 1 Mb sequentially	2.010 seconds	223.88 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.210 seconds	184.58 khorners
C Savage test	11.000 seconds	254.55 khorners
Total time for execution	637.710 seconds	1693.56 khorners

Total Khornerstones = 9130.205 khorners

table 6.4-14 results [NWS-1250 12MB]

System: generic
Repetitions Count: 10

NWS-1250 12MB		
C sort of real numbers	164.510 seconds	173.24 khorners
C sort of integers	81.970 seconds	189.09 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Sieve test	0.710 seconds	211.27 khorners
Fortran Sieve test	0.720 seconds	208.33 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
Fortran Whetstone test	7.110 seconds	168.78 khorners
C Fib. test	22.600 seconds	190.27 khorners
C Whetstone SP test	6.400 seconds	234.37 khorners
C Whetstone DP test	6.110 seconds	212.77 khorners
C Sieve test	61.100 seconds	180.03 khorners
C ackerman test	51.110 seconds	176.09 khorners
Build 8 Mb file test	7.660 seconds	718.02 khorners
Read 8 Mb randomly	15.980 seconds	1752.19 khorners
Read 8 Mb sequentially	4.160 seconds	769.23 khorners
Read 1 Mb sequentially	0.500 seconds	900.00 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.210 seconds	184.58 khorners
C Savage test	11.000 seconds	254.55 khorners
Total time for execution	475.040 seconds	2273.49 khorners

Total Khornerstones = 12436.030 khorners

table 6.4-15 results [NWS-1450 8MB]

System: generic
Repetitions Count: 10

NWS-1450 8MB		
C sort of real numbers	166.200 seconds	171.48 khorners
C sort of integers	82.500 seconds	187.88 khorners
Fortran Sieve test	0.900 seconds	166.67 khorners
Fortran Sieve test	0.900 seconds	166.67 khorners
Fortran Sieve test	0.900 seconds	166.67 khorners
Fortran Whetstone test	7.200 seconds	166.67 khorners
Fortran Whetstone test	7.200 seconds	166.67 khorners
Fortran Whetstone test	7.200 seconds	166.67 khorners
C Fib. test	22.720 seconds	189.26 khorners
C Whetstone SP test	6.400 seconds	234.37 khorners
C Whetstone DP test	6.190 seconds	210.02 khorners
C Sieve test	61.460 seconds	178.98 khorners
C ackerman test	51.500 seconds	174.76 khorners
Build 8 Mb file test	7.150 seconds	769.23 khorners
Read 8 Mb randomly	166.770 seconds	167.90 khorners
Read 8 Mb sequentially	13.930 seconds	229.72 khorners
Read 1 Mb sequentially	2.090 seconds	215.31 khorners
Read 256 Kb sequentially	0.130 seconds	923.08 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.310 seconds	182.60 khorners
C Savage test	11.010 seconds	254.31 khorners
Total time for execution	647.790 seconds	1667.21 khorners

Total Khornerstones = 8756.102 khorners

table 6.4-16 results [NWS-1450 16MB]

System: generic
Repetitions Count: 10

NWS-1450 16MB		
C sort of real numbers	166.210 seconds	171.47 khorners
C sort of integers	82.420 seconds	188.06 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
C Fib. test	22.620 seconds	190.10 khorners
C Whetstone SP test	6.400 seconds	234.37 khorners
C Whetstone DP test	6.110 seconds	212.77 khorners
C Sieve test	61.410 seconds	179.12 khorners
C ackerman test	51.510 seconds	174.72 khorners
Build 8 Mb file test	7.000 seconds	785.71 khorners
Read 8 Mb randomly	15.340 seconds	1825.29 khorners
Read 8 Mb sequentially	4.010 seconds	798.01 khorners
Read 1 Mb sequentially	0.420 seconds	1071.43 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.310 seconds	182.60 khorners
C Savage test	11.010 seconds	254.31 khorners
Total time for execution	478.630 seconds	2256.44 khorners

Total Khornerstones = 12669.720 khorners

table 6.4-17 results [NWS-1460 8MB]

System: generic
Repetitions Count: 10

NWS-1460 8MB		
C sort of real numbers	166.220 seconds	171.46 khorners
C sort of integers	82.500 seconds	187.88 khorners
Fortran Sieve test	0.900 seconds	166.67 khorners
Fortran Sieve test	0.900 seconds	166.67 khorners
Fortran Sieve test	0.900 seconds	166.67 khorners
Fortran Whetstone test	7.200 seconds	166.67 khorners
Fortran Whetstone test	7.200 seconds	166.67 khorners
Fortran Whetstone test	7.200 seconds	166.67 khorners
C Fib. test	22.700 seconds	189.43 khorners
C Whetstone SP test	6.390 seconds	234.74 khorners
C Whetstone DP test	6.100 seconds	213.11 khorners
C Sieve test	61.460 seconds	178.98 khorners
C ackerman test	51.500 seconds	174.76 khorners
Build 8 Mb file test	7.150 seconds	769.23 khorners
Read 8 Mb randomly	167.040 seconds	167.62 khorners
Read 8 Mb sequentially	13.850 seconds	231.05 khorners
Read 1 Mb sequentially	2.040 seconds	220.59 khorners
Read 256 Kb sequentially	0.130 seconds	923.08 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.310 seconds	182.60 khorners
C Savage test	11.010 seconds	254.31 khorners
Total time for execution	647.510 seconds	1667.93 khorners

Total Khornerstones = 8766.767 khorners

table 6.4-18 results [NWS-1460 16MB]

System: generic
Repetitions Count: 10

NWS-1460 16MB		
C sort of real numbers	166.210 seconds	171.47 khorners
C sort of integers	82.420 seconds	188.06 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
Fortran Whetstone test	7.120 seconds	168.54 khorners
C Fib. test	22.620 seconds	190.10 khorners
C Whetstone SP test	6.310 seconds	237.72 khorners
C Whetstone DP test	6.120 seconds	212.42 khorners
C Sieve test	61.410 seconds	179.12 khorners
C ackerman test	51.510 seconds	174.72 khorners
Build 8 Mb file test	7.010 seconds	784.59 khorners
Read 8 Mb randomly	14.610 seconds	1916.50 khorners
Read 8 Mb sequentially	3.990 seconds	802.00 khorners
Read 1 Mb sequentially	0.410 seconds	1097.56 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.310 seconds	182.60 khorners
C Savage test	11.000 seconds	254.55 khorners
Total time for execution	478.310 seconds	2257.95 khorners

Total Khornerstones = 12794.670 khorners

table 6.4-19 results [PWS-1560 4MB]

System: generic
Repetitions Count: 10

PWS-1560 4MB		
C sort of real numbers	188.480 seconds	151.21 khorners
C sort of integers	82.410 seconds	188.08 khorners
Fortran Sieve test	1.200 seconds	125.00 khorners
Fortran Sieve test	1.200 seconds	125.00 khorners
Fortran Sieve test	1.120 seconds	133.93 khorners
Fortran Whetstone test	9.120 seconds	131.58 khorners
Fortran Whetstone test	9.120 seconds	131.58 khorners
Fortran Whetstone test	9.120 seconds	131.58 khorners
C Fib. test	22.610 seconds	190.18 khorners
C Whetstone SP test	8.410 seconds	178.36 khorners
C Whetstone DP test	7.700 seconds	168.83 khorners
C Sieve test	61.410 seconds	179.12 khorners
C ackerman test	51.500 seconds	174.76 khorners
Build 8 Mb file test	9.220 seconds	596.53 khorners
Read 8 Mb randomly	178.850 seconds	156.56 khorners
Read 8 Mb sequentially	32.390 seconds	98.80 khorners
Read 1 Mb sequentially	4.460 seconds	100.90 khorners
Read 256 Kb sequentially	0.200 seconds	600.00 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	9.410 seconds	180.66 khorners
C Savage test	12.300 seconds	227.64 khorners
Total time for execution	713.030 seconds	1514.66 khorners

Total Khornerstones = 5684.954 khorners

table 6.4-20 results [PWS-1560 8MB]

System: generic
Repetitions Count: 10

PWS-1560 8MB		
C sort of real numbers	188.510 seconds	151.19 khorners
C sort of integers	82.410 seconds	188.08 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Whetstone test	9.020 seconds	133.04 khorners
Fortran Whetstone test	9.030 seconds	132.89 khorners
Fortran Whetstone test	9.030 seconds	132.89 khorners
C Fib. test	22.630 seconds	190.01 khorners
C Whetstone SP test	8.410 seconds	178.36 khorners
C Whetstone DP test	7.610 seconds	170.83 khorners
C Sieve test	61.410 seconds	179.12 khorners
C ackerman test	51.510 seconds	174.72 khorners
Build 8 Mb file test	6.930 seconds	793.65 khorners
Read 8 Mb randomly	14.200 seconds	1971.83 khorners
Read 8 Mb sequentially	4.010 seconds	798.01 khorners
Read 1 Mb sequentially	0.420 seconds	1071.43 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.320 seconds	182.40 khorners
C Savage test	12.210 seconds	229.32 khorners
Total time for execution	510.410 seconds	2115.95 khorners

Total Khornerstones = 12433.410 khorners

table 6.4-21 results [PWS-1560 16MB]

System: generic
Repetitions Count: 10

PWS-1560 16MB		
C sort of real numbers	188.510 seconds	151.19 khorners
C sort of integers	82.410 seconds	188.08 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Whetstone test	9.020 seconds	133.04 khorners
Fortran Whetstone test	9.030 seconds	132.89 khorners
Fortran Whetstone test	9.030 seconds	132.89 khorners
C Fib. test	22.620 seconds	190.10 khorners
C Whetstone SP test	8.410 seconds	178.36 khorners
C Whetstone DP test	7.610 seconds	170.83 khorners
C Sieve test	61.410 seconds	179.12 khorners
C ackerman test	51.510 seconds	174.72 khorners
Build 8 Mb file test	6.990 seconds	786.84 khorners
Read 8 Mb randomly	14.170 seconds	1976.01 khorners
Read 8 Mb sequentially	3.990 seconds	802.00 khorners
Read 1 Mb sequentially	0.420 seconds	1071.43 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	9.310 seconds	182.60 khorners
C Savage test	12.210 seconds	229.32 khorners
Total time for execution	510.200 seconds	2116.82 khorners

Total Khornerstones = 12435.924 khorners

table 6.4-22 results [NWS-1750 4MB]

System: generic
Repetitions Count: 10

NWS-1750 4MB		
C sort of real numbers	164.080 seconds	173.70 khorners
C sort of integers	81.610 seconds	189.93 khorners
Fortran Sieve test	0.820 seconds	182.93 khorners
Fortran Sieve test	0.810 seconds	185.19 khorners
Fortran Sieve test	0.740 seconds	202.70 khorners
Fortran Whetstone test	6.970 seconds	172.17 khorners
Fortran Whetstone test	6.920 seconds	173.41 khorners
Fortran Whetstone test	6.920 seconds	173.41 khorners
C Fib. test	22.610 seconds	190.18 khorners
C Whetstone SP test	6.410 seconds	234.01 khorners
C Whetstone DP test	6.130 seconds	212.07 khorners
C Sieve test	61.220 seconds	179.68 khorners
C ackerman test	51.690 seconds	174.11 khorners
Build 8 Mb file test	8.770 seconds	627.14 khorners
Read 8 Mb randomly	189.820 seconds	147.51 khorners
Read 8 Mb sequentially	26.670 seconds	119.98 khorners
Read 1 Mb sequentially	3.600 seconds	125.00 khorners
Read 256 Kb sequentially	0.200 seconds	600.00 khorners
Read 16 Kb sequentially	0.120 seconds	166.67 khorners
Dhrystone test	8.470 seconds	200.71 khorners
C Savage test	10.950 seconds	255.71 khorners
Total time for execution	676.910 seconds	1595.49 khorners

Total Khornerstones = 6281.682 khorners

table 6.4-23 results [NWS-1750 8MB]

System: generic
Repetitions Count: 10

NWS-1750 8MB		
C sort of real numbers	164.130 seconds	173.64 khorners
C sort of integers	81.630 seconds	189.88 khorners
Fortran Sieve test	1.130 seconds	132.74 khorners
Fortran Sieve test	1.120 seconds	133.93 khorners
Fortran Sieve test	1.120 seconds	133.93 khorners
Fortran Whetstone test	7.020 seconds	170.94 khorners
Fortran Whetstone test	7.030 seconds	170.70 khorners
Fortran Whetstone test	7.020 seconds	170.94 khorners
C Fib. test	22.610 seconds	190.18 khorners
C Whetstone SP test	6.410 seconds	234.01 khorners
C Whetstone DP test	6.200 seconds	209.68 khorners
C Sieve test	61.200 seconds	179.74 khorners
C ackerman test	51.680 seconds	174.15 khorners
Build 8 Mb file test	5.790 seconds	949.91 khorners
Read 8 Mb randomly	129.980 seconds	215.42 khorners
Read 8 Mb sequentially	16.900 seconds	189.35 khorners
Read 1 Mb sequentially	2.910 seconds	154.64 khorners
Read 256 Kb sequentially	0.140 seconds	857.14 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	8.410 seconds	202.14 khorners
C Savage test	10.910 seconds	256.65 khorners
Total time for execution	609.710 seconds	1771.33 khorners

Total Khornerstones = 7061.039 khorners

table 6.4-24 results [NWS-1750 16MB]

System: generic
Repetitions Count: 10

NWS-1750 16MB		
C sort of real numbers	163.900 seconds	173.89 khorners
C sort of integers	81.470 seconds	190.25 khorners
Fortran Sieve test	1.030 seconds	145.63 khorners
Fortran Sieve test	1.030 seconds	145.63 khorners
Fortran Sieve test	1.030 seconds	145.63 khorners
Fortran Whetstone test	6.930 seconds	173.16 khorners
Fortran Whetstone test	6.930 seconds	173.16 khorners
Fortran Whetstone test	6.930 seconds	173.16 khorners
C Fib. test	22.600 seconds	190.27 khorners
C Whetstone SP test	6.320 seconds	237.34 khorners
C Whetstone DP test	6.110 seconds	212.77 khorners
C Sieve test	61.110 seconds	180.00 khorners
C ackerman test	51.510 seconds	174.72 khorners
Build 8 Mb file test	5.470 seconds	1005.48 khorners
Read 8 Mb randomly	7.630 seconds	3669.72 khorners
Read 8 Mb sequentially	3.070 seconds	1042.35 khorners
Read 1 Mb sequentially	0.410 seconds	1097.56 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	8.420 seconds	201.90 khorners
C Savage test	10.820 seconds	258.78 khorners
Total time for execution	463.880 seconds	2328.19 khorners

Total Khornerstones = 15010.508 khorners

table 6.4-25 results [NWS-1850 16MB]

System: generic
Repetitions Count: 10

NWS-1850 16MB		
C sort of real numbers	157.940 seconds	180.45 khorners
C sort of integers	77.200 seconds	200.78 khorners
Fortran Sieve test	0.210 seconds	714.29 khorners
Fortran Sieve test	0.210 seconds	714.29 khorners
Fortran Sieve test	0.210 seconds	714.29 khorners
Fortran Whetstone test	6.410 seconds	187.21 khorners
Fortran Whetstone test	6.410 seconds	187.21 khorners
Fortran Whetstone test	6.410 seconds	187.21 khorners
C Fib. test	20.100 seconds	213.93 khorners
C Whetstone SP test	6.110 seconds	245.50 khorners
C Whetstone DP test	5.900 seconds	220.34 khorners
C Sieve test	58.310 seconds	188.65 khorners
C ackerman test	46.210 seconds	194.76 khorners
Build 8 Mb file test	4.300 seconds	1279.07 khorners
Read 8 Mb randomly	12.970 seconds	2158.83 khorners
Read 8 Mb sequentially	2.600 seconds	1230.77 khorners
Read 1 Mb sequentially	0.300 seconds	1500.00 khorners
Read 256 Kb sequentially	0.020 seconds	6000.00 khorners
Read 16 Kb sequentially	0.000 seconds	0.00 khorners*1
Dhrystone test	6.600 seconds	257.58 khorners
C Savage test	10.510 seconds	266.41 khorners
Total time for execution	434.440 seconds	2485.96 khorners

Total Khornerstones = 19327.498 khorners*2

[NOTE] *1 Due to the lack of the accuracy of timer available, measured time period becomes 0 seconds. In this case, khornerstone can not be computed: therefore, giving 0 khorners as the result. Read 16Kb sequentially are reported as 0.000 seconds and 0.00 khorners, because files are cached by the dynamic allocation buffer in NEWS-OS Release 4.0C/R and the cache "hit" in this case.

*2 This value does not reflect the performance of this machine, and can not be compared with other obtained results. As explained before, some results are reported as zero, which in return affect the total values.

table 6.4-26 results [NWS-1850 32MB]

System: generic
Repetitions Count: 10

NWS-1850 32MB		
C sort of real numbers	157.820 seconds	180.59 khorners
C sort of integers	77.110 seconds	201.01 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.440 seconds	340.91 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
C Fib. test	20.100 seconds	213.93 khorners
C Whetstone SP test	6.110 seconds	245.50 khorners
C Whetstone DP test	5.910 seconds	219.97 khorners
C Sieve test	58.320 seconds	188.61 khorners
C ackerman test	46.210 seconds	194.76 khorners
Build 8 Mb file test	4.350 seconds	1264.37 khorners
Read 8 Mb randomly	12.530 seconds	2234.64 khorners
Read 8 Mb sequentially	2.610 seconds	1226.05 khorners
Read 1 Mb sequentially	0.310 seconds	1451.61 khorners
Read 256 Kb sequentially	0.040 seconds	3000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	6.620 seconds	256.80 khorners
C Savage test	10.510 seconds	266.41 khorners
Total time for execution	434.580 seconds	2485.16 khorners

Total Khornerstones = 17894.703 khorners

table 6.4-27 results [NWS-1860 16MB]

System: generic
Repetitions Count: 10

NWS-1860 16MB		
C sort of real numbers	157.910 seconds	180.48 khorners
C sort of integers	77.160 seconds	200.88 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
C Fib. test	20.060 seconds	214.36 khorners
C Whetstone SP test	6.110 seconds	245.50 khorners
C Whetstone DP test	5.910 seconds	219.97 khorners
C Sieve test	58.310 seconds	188.65 khorners
C ackerman test	46.210 seconds	194.76 khorners
Build 8 Mb file test	3.470 seconds	1585.01 khorners
Read 8 Mb randomly	6.950 seconds	4028.78 khorners
Read 8 Mb sequentially	2.210 seconds	1447.96 khorners
Read 1 Mb sequentially	0.270 seconds	1666.67 khorners
Read 256 Kb sequentially	0.010 seconds	12000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	6.610 seconds	257.19 khorners
C Savage test	10.510 seconds	266.41 khorners
Total time for execution	427.780 seconds	2524.66 khorners

Total Khornerstones = 29827.482 khorners

table 6.4-28 results [NWS-1860 32MB]

System: generic
Repetitions Count: 10

NWS-1860 32MB		
C sort of real numbers	158.010 seconds	180.37 khorners
C sort of integers	77.210 seconds	200.75 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
C Fib. test	20.070 seconds	214.25 khorners
C Whetstone SP test	6.110 seconds	245.50 khorners
C Whetstone DP test	5.910 seconds	219.97 khorners
C Sieve test	58.310 seconds	188.65 khorners
C ackerman test	46.210 seconds	194.76 khorners
Build 8 Mb file test	3.460 seconds	1589.60 khorners
Read 8 Mb randomly	7.040 seconds	3977.27 khorners
Read 8 Mb sequentially	2.210 seconds	1447.96 khorners
Read 1 Mb sequentially	0.240 seconds	1875.00 khorners
Read 256 Kb sequentially	0.010 seconds	12000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	6.610 seconds	257.19 khorners
C Savage test	10.510 seconds	266.41 khorners
Total time for execution	427.880 seconds	2524.07 khorners

Total Khornerstones = 29987.949 khorners

table 6.4-29 results [NWS-1960 16MB]

System: generic
Repetitions Count: 10

NWS-1960 16MB		
C sort of real numbers	157.900 seconds	180.49 khorners
C sort of integers	77.150 seconds	200.91 khorners
Fortran Sieve test	0.210 seconds	714.29 khorners
Fortran Sieve test	0.210 seconds	714.29 khorners
Fortran Sieve test	0.210 seconds	714.29 khorners
Fortran Whetstone test	6.410 seconds	187.21 khorners
Fortran Whetstone test	6.410 seconds	187.21 khorners
Fortran Whetstone test	6.410 seconds	187.21 khorners
C Fib. test	20.100 seconds	213.93 khorners
C Whetstone SP test	6.110 seconds	245.50 khorners
C Whetstone DP test	5.900 seconds	220.34 khorners
C Sieve test	58.310 seconds	188.65 khorners
C ackerman test	46.210 seconds	194.76 khorners
Build 8 Mb file test	3.450 seconds	1594.20 khorners
Read 8 Mb randomly	10.180 seconds	2750.49 khorners
Read 8 Mb sequentially	2.200 seconds	1454.55 khorners
Read 1 Mb sequentially	0.280 seconds	1607.14 khorners
Read 256 Kb sequentially	0.010 seconds	12000.00 khorners
Read 16 Kb sequentially	0.000 seconds	0.00 khorners*1
Dhrystone test	6.600 seconds	257.58 khorners
C Savage test	10.510 seconds	266.41 khorners
Total time for execution	430.830 seconds	2506.79 khorners

Total Khornerstones = 26586.219 khorners*2

[NOTE] *1 Due to the lack of the accuracy of timer available, measured time period becomes 0 seconds. In this case, khornerstone can not be computed: therefore, giving 0 khorners as the result. Read 16Kb sequentially are reported as 0.000 seconds and 0.00 khorners, because files are cached by the dynamic allocation buffer in NEWS-OS Release 4.0C/R and the cache "hit" in this case.

*2 This value does not reflect the performance of this machine, and can not be compared with other obtained results. As explained before, some results are reported as zero, which in return affect the total values.

table 6.4-30 results [NWS-1960 32MB]

System: generic
Repetitions Count: 10

NWS-1960 32MB		
C sort of real numbers	157.820 seconds	180.59 khorners
C sort of integers	77.160 seconds	200.88 khorners
Fortran Sieve test	0.220 seconds	681.82 khorners
Fortran Sieve test	0.230 seconds	652.17 khorners
Fortran Sieve test	0.230 seconds	652.17 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
Fortran Whetstone test	6.430 seconds	186.63 khorners
Fortran Whetstone test	6.420 seconds	186.92 khorners
C Fib. test	20.090 seconds	214.04 khorners
C Whetstone SP test	6.120 seconds	245.10 khorners
C Whetstone DP test	5.910 seconds	219.97 khorners
C Sieve test	58.330 seconds	188.58 khorners
C ackerman test	46.220 seconds	194.72 khorners
Build 8 Mb file test	3.380 seconds	1627.22 khorners
Read 8 Mb randomly	10.780 seconds	2597.40 khorners
Read 8 Mb sequentially	2.210 seconds	1447.96 khorners
Read 1 Mb sequentially	0.260 seconds	1730.77 khorners
Read 256 Kb sequentially	0.020 seconds	6000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	6.610 seconds	257.19 khorners
C Savage test	10.520 seconds	266.16 khorners
Total time for execution	431.370 seconds	2503.65 khorners

Total Khornerstones = 22420.846 khorners

table 6.4-31 results [NWS-3260 16MB]

System: generic
Repetitions Count: 10

NWS-3260 16MB		
C sort of real numbers	16.010 seconds	1780.14 khorners
C sort of integers	13.900 seconds	1115.11 khorners
Fortran Sieve test	0.570 seconds	263.16 khorners
Fortran Sieve test	0.570 seconds	263.16 khorners
Fortran Sieve test	0.570 seconds	263.16 khorners
Fortran Whetstone test	1.070 seconds	1121.50 khorners
Fortran Whetstone test	1.060 seconds	1132.08 khorners
Fortran Whetstone test	1.070 seconds	1121.50 khorners
C Fib. test	7.610 seconds	565.05 khorners
C Whetstone SP test	0.810 seconds	1851.85 khorners
C Whetstone DP test	0.810 seconds	1604.94 khorners
C Sieve test	11.510 seconds	955.69 khorners
C ackerman test	13.700 seconds	656.93 khorners
Build 8 Mb file test	3.910 seconds	1406.65 khorners
Read 8 Mb randomly	3.120 seconds	8974.36 khorners
Read 8 Mb sequentially	4.030 seconds	794.04 khorners
Read 1 Mb sequentially	0.310 seconds	1451.61 khorners
Read 256 Kb sequentially	0.030 seconds	4000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	2.210 seconds	769.23 khorners
C Savage test	3.310 seconds	845.92 khorners
Total time for execution	94.110 seconds	11475.93 khorners

Total Khornerstones = 44411.996 khorners

table 6.4-32 results [NWS-3260 32MB]

System: generic
Repetitions Count: 10

NWS-3260 32MB		
C sort of real numbers	16.650 seconds	1711.71 khorners
C sort of integers	14.520 seconds	1067.49 khorners
Fortran Sieve test	0.580 seconds	258.62 khorners
Fortran Sieve test	0.580 seconds	258.62 khorners
Fortran Sieve test	0.580 seconds	258.62 khorners
Fortran Whetstone test	1.090 seconds	1100.92 khorners
Fortran Whetstone test	1.090 seconds	1100.92 khorners
Fortran Whetstone test	1.100 seconds	1090.91 khorners
C Fib. test	7.610 seconds	565.05 khorners
C Whetstone SP test	0.820 seconds	1829.27 khorners
C Whetstone DP test	0.820 seconds	1585.37 khorners
C Sieve test	11.520 seconds	954.86 khorners
C ackerman test	13.710 seconds	656.46 khorners
Build 8 Mb file test	3.880 seconds	1417.53 khorners
Read 8 Mb randomly	3.180 seconds	8805.03 khorners
Read 8 Mb sequentially	3.910 seconds	818.41 khorners
Read 1 Mb sequentially	0.310 seconds	1451.61 khorners
Read 256 Kb sequentially	0.070 seconds	1714.29 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	2.210 seconds	769.23 khorners
C Savage test	3.310 seconds	845.92 khorners
Total time for execution	95.740 seconds	11280.55 khorners

Total Khornerstones = 41541.379 khorners

table 6.4-33 results [NWS-3260 48MB]

System: generic
Repetitions Count: 10

NWS-3260 48MB		
C sort of real numbers	16.010 seconds	1780.14 khorners
C sort of integers	13.920 seconds	1113.51 khorners
Fortran Sieve test	0.580 seconds	258.62 khorners
Fortran Sieve test	0.580 seconds	258.62 khorners
Fortran Sieve test	0.580 seconds	258.62 khorners
Fortran Whetstone test	1.080 seconds	1111.11 khorners
Fortran Whetstone test	1.080 seconds	1111.11 khorners
Fortran Whetstone test	1.100 seconds	1090.91 khorners
C Fib. test	7.610 seconds	565.05 khorners
C Whetstone SP test	0.820 seconds	1829.27 khorners
C Whetstone DP test	0.820 seconds	1585.37 khorners
C Sieve test	11.520 seconds	954.86 khorners
C ackerman test	13.710 seconds	656.46 khorners
Build 8 Mb file test	3.880 seconds	1417.53 khorners
Read 8 Mb randomly	3.120 seconds	8974.36 khorners
Read 8 Mb sequentially	4.250 seconds	752.94 khorners
Read 1 Mb sequentially	0.310 seconds	1451.61 khorners
Read 256 Kb sequentially	0.060 seconds	2000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	2.210 seconds	769.23 khorners
C Savage test	3.310 seconds	845.92 khorners
Total time for execution	94.590 seconds	11417.70 khorners

Total Khornerstones = 42202.922 khorners

table 6.4-34 results [NWS-3460 8MB]

System: generic
Repetitions Count: 10

NWS-3460 8MB		
C sort of real numbers	16.800 seconds	1696.43 khorners
C sort of integers	15.380 seconds	1007.80 khorners
Fortran Sieve test	1.920 seconds	78.13 khorners
Fortran Sieve test	1.930 seconds	77.72 khorners
Fortran Sieve test	1.880 seconds	79.79 khorners
Fortran Whetstone test	1.730 seconds	693.64 khorners
Fortran Whetstone test	1.730 seconds	693.64 khorners
Fortran Whetstone test	1.750 seconds	685.71 khorners
C Fib. test	7.900 seconds	544.30 khorners
C Whetstone SP test	0.910 seconds	1648.35 khorners
C Whetstone DP test	0.900 seconds	1444.44 khorners
C Sieve test	11.910 seconds	923.59 khorners
C ackerman test	14.010 seconds	642.40 khorners
Build 8 Mb file test	3.340 seconds	1646.71 khorners
Read 8 Mb randomly	3.710 seconds	7547.17 khorners
Read 8 Mb sequentially	7.950 seconds	402.52 khorners
Read 1 Mb sequentially	1.200 seconds	375.00 khorners
Read 256 Kb sequentially	0.110 seconds	1090.91 khorners
Read 16 Kb sequentially	0.100 seconds	200.00 khorners
Dhrystone test	2.500 seconds	680.00 khorners
C Savage test	3.500 seconds	800.00 khorners
Total time for execution	116.030 seconds	9307.94 khorners

Total Khornerstones = 32266.191 khorners

table 6.4-35 results [NWS-3460 16MB]

System: generic
Repetitions Count: 10

NWS-3460 16MB		
C sort of real numbers	17.130 seconds	1663.75 khorners
C sort of integers	15.050 seconds	1029.90 khorners
Fortran Sieve test	1.650 seconds	90.91 khorners
Fortran Sieve test	1.630 seconds	92.02 khorners
Fortran Sieve test	1.620 seconds	92.59 khorners
Fortran Whetstone test	1.430 seconds	839.16 khorners
Fortran Whetstone test	1.440 seconds	833.33 khorners
Fortran Whetstone test	1.460 seconds	821.92 khorners
C Fib. test	7.800 seconds	551.28 khorners
C Whetstone SP test	0.800 seconds	1875.00 khorners
C Whetstone DP test	0.800 seconds	1625.00 khorners
C Sieve test	11.800 seconds	932.20 khorners
C ackerman test	13.900 seconds	647.48 khorners
Build 8 Mb file test	2.980 seconds	1845.64 khorners
Read 8 Mb randomly	3.200 seconds	8750.00 khorners
Read 8 Mb sequentially	2.000 seconds	1600.00 khorners
Read 1 Mb sequentially	0.200 seconds	2250.00 khorners
Read 256 Kb sequentially	0.000 seconds	0.00 khorners*1
Read 16 Kb sequentially	0.000 seconds	0.00 khorners*1
Dhrystone test	2.400 seconds	708.33 khorners
C Savage test	3.400 seconds	823.53 khorners
Total time for execution	102.840 seconds	10501.75 khorners

Total Khornerstones = 37573.805 khorners*2

[NOTE] *1 Due to the lack of the accuracy of timer available, measured time period becomes 0 seconds. In this case, khornerstone can not be computed: therefore, giving 0 khorners as the result. Read 16Kb sequentially are reported as 0.000 seconds and 0.00 khorners, because files are cached by the dynamic allocation buffer in NEWS-OS Release 4.0C/R and the cache "hit" in this case.

*2 This value does not reflect the performance of this machine, and can not be compared with other obtained results. As explained before, some results are reported as zero, which in return affect the total values.

table 6.4-36 results [NWS-3720 16MB]

System: generic
Repetitions Count: 10

NWS-3720 16MB		
C sort of real numbers	16.240 seconds	1754.93 khorners
C sort of integers	14.270 seconds	1086.19 khorners
Fortran Sieve test	0.650 seconds	230.77 khorners
Fortran Sieve test	0.660 seconds	227.27 khorners
Fortran Sieve test	0.650 seconds	230.77 khorners
Fortran Whetstone test	1.130 seconds	1061.95 khorners
Fortran Whetstone test	1.130 seconds	1061.95 khorners
Fortran Whetstone test	1.130 seconds	1061.95 khorners
C Fib. test	7.600 seconds	565.79 khorners
C Whetstone SP test	0.810 seconds	1851.85 khorners
C Whetstone DP test	0.810 seconds	1604.94 khorners
C Sieve test	11.510 seconds	955.69 khorners
C ackerman test	13.700 seconds	656.93 khorners
Build 8 Mb file test	2.950 seconds	1864.41 khorners
Read 8 Mb randomly	3.130 seconds	8945.69 khorners
Read 8 Mb sequentially	2.010 seconds	1592.04 khorners
Read 1 Mb sequentially	0.210 seconds	2142.86 khorners
Read 256 Kb sequentially	0.010 seconds	12000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	2.210 seconds	769.23 khorners
C Savage test	3.320 seconds	843.37 khorners
Total time for execution	92.650 seconds	11656.77 khorners

Total Khornerstones = 54165.348 khorners

table 6.4-37 results [NWS-3840 16MB]

System: generic
Repetitions Count: 10

NWS-3840 16MB		
C sort of real numbers	15.850 seconds	1798.11 khorners
C sort of integers	13.120 seconds	1181.40 khorners
Fortran Sieve test	0.160 seconds	937.50 khorners
Fortran Sieve test	0.090 seconds	1666.67 khorners
Fortran Sieve test	0.090 seconds	1666.67 khorners
Fortran Whetstone test	0.940 seconds	1276.60 khorners
Fortran Whetstone test	0.940 seconds	1276.60 khorners
Fortran Whetstone test	0.950 seconds	1263.16 khorners
C Fib. test	6.710 seconds	640.83 khorners
C Whetstone SP test	0.810 seconds	1851.85 khorners
C Whetstone DP test	0.800 seconds	1625.00 khorners
C Sieve test	10.700 seconds	1028.04 khorners
C ackerman test	12.510 seconds	719.42 khorners
Build 8 Mb file test	1.520 seconds	3618.42 khorners
Read 8 Mb randomly	2.260 seconds	12389.38 khorners
Read 8 Mb sequentially	5.730 seconds	558.46 khorners
Read 1 Mb sequentially	0.220 seconds	2045.45 khorners
Read 256 Kb sequentially	0.020 seconds	6000.00 khorners
Read 16 Kb sequentially	0.020 seconds	1000.00 khorners
Dhrystone test	1.620 seconds	1049.38 khorners
C Savage test	3.220 seconds	869.57 khorners
Total time for execution	82.790 seconds	13045.05 khorners

Total Khornerstones = 57507.566 khorners

table 6.4-38 results [NWS-3860 16MB]

System: generic
Repetitions Count: 10

NWS-3860 16MB		
C sort of real numbers	16.540 seconds	1723.10 khorners
C sort of integers	14.250 seconds	1087.72 khorners
Fortran Sieve test	0.160 seconds	937.50 khorners
Fortran Sieve test	0.100 seconds	1500.00 khorners
Fortran Sieve test	1.520 seconds	98.68 khorners
Fortran Whetstone test	0.940 seconds	1276.60 khorners
Fortran Whetstone test	0.940 seconds	1276.60 khorners
Fortran Whetstone test	0.930 seconds	1290.32 khorners
C Fib. test	6.710 seconds	640.83 khorners
C Whetstone SP test	0.810 seconds	1851.85 khorners
C Whetstone DP test	0.800 seconds	1625.00 khorners
C Sieve test	10.700 seconds	1028.04 khorners
C ackerman test	12.510 seconds	719.42 khorners
Build 8 Mb file test	1.430 seconds	3846.15 khorners
Read 8 Mb randomly	2.270 seconds	12334.80 khorners
Read 8 Mb sequentially	4.560 seconds	701.75 khorners
Read 1 Mb sequentially	0.210 seconds	2142.86 khorners
Read 256 Kb sequentially	0.020 seconds	6000.00 khorners
Read 16 Kb sequentially	0.010 seconds	2000.00 khorners
Dhrystone test	1.610 seconds	1055.90 khorners
C Savage test	3.220 seconds	869.57 khorners
Total time for execution	83.850 seconds	12880.14 khorners

Total Khornerstones = 56886.840 khorners

table 6.4-39 results [NWS-3870 64MB]

System: generic
Repetitions Count: 10

NWS-3870 64MB		
C sort of real numbers	12.600 seconds	2261.90 khorners
C sort of integers	10.500 seconds	1476.19 khorners
Fortran Sieve test	0.070 seconds	2142.86 khorners
Fortran Sieve test	0.060 seconds	2500.00 khorners
Fortran Sieve test	0.060 seconds	2500.00 khorners
Fortran Whetstone test	0.740 seconds	1621.62 khorners
Fortran Whetstone test	0.740 seconds	1621.62 khorners
Fortran Whetstone test	0.740 seconds	1621.62 khorners
C Fib. test	5.400 seconds	796.30 khorners
C Whetstone SP test	0.700 seconds	2142.86 khorners
C Whetstone DP test	0.610 seconds	2131.15 khorners
C Sieve test	8.510 seconds	1292.60 khorners
C ackerman test	10.000 seconds	900.00 khorners
Build 8 Mb file test	1.530 seconds	3594.77 khorners
Read 8 Mb randomly	1.810 seconds	15469.61 khorners
Read 8 Mb sequentially	5.040 seconds	634.92 khorners
Read 1 Mb sequentially	0.110 seconds	4090.91 khorners
Read 256 Kb sequentially	0.000 seconds	0.00 khorners*1
Read 16 Kb sequentially	0.000 seconds	0.00 khorners*1
Dhrystone test	1.300 seconds	1307.69 khorners
C Savage test	2.600 seconds	1076.92 khorners
Total time for execution	66.850 seconds	16155.57 khorners

Total Khornerstones = 65339.117 khorners*2

[NOTE] *1 Due to the lack of the accuracy of timer available, measured time period becomes 0 seconds. In this case, khornerstone can not be computed: therefore, giving 0 khorners as the result. Read 16Kb sequentially are reported as 0.000 seconds and 0.00 khorners, because files are cached by the dynamic allocation buffer in NEWS-OS Release 4.0C/R and the cache "hit" in this case.

*2 This value does not reflect the performance of this machine, and can not be compared with other obtained results. As explained before, some results are reported as zero, which in return affect the total values.

table 6.4-40 results [NWS-3870 128MB]

System: generic
Repetitions Count: 10

NWS-3870 128MB		
C sort of real numbers	12.630 seconds	2256.53 khorners
C sort of integers	10.610 seconds	1460.89 khorners
Fortran Sieve test	0.120 seconds	1250.00 khorners
Fortran Sieve test	0.060 seconds	2500.00 khorners
Fortran Sieve test	1.830 seconds	81.97 khorners
Fortran Whetstone test	0.750 seconds	1600.00 khorners
Fortran Whetstone test	0.740 seconds	1621.62 khorners
Fortran Whetstone test	0.740 seconds	1621.62 khorners
C Fib. test	5.400 seconds	796.30 khorners
C Whetstone SP test	0.640 seconds	2343.75 khorners
C Whetstone DP test	0.600 seconds	2166.67 khorners
C Sieve test	8.510 seconds	1292.60 khorners
C ackerman test	10.010 seconds	899.10 khorners
Build 8 Mb file test	1.200 seconds	4583.33 khorners
Read 8 Mb randomly	1.720 seconds	16279.07 khorners
Read 8 Mb sequentially	5.310 seconds	602.64 khorners
Read 1 Mb sequentially	0.110 seconds	4090.91 khorners
Read 256 Kb sequentially	0.000 seconds	0.00 khorners*1
Read 16 Kb sequentially	0.000 seconds	0.00 khorners*1
Dhrystone test	1.300 seconds	1307.69 khorners
C Savage test	2.600 seconds	1076.92 khorners
Total time for execution	67.820 seconds	15924.51 khorners

Total Khornerstones = 63756.109 khorners*2

[NOTE] *1 Due to the lack of the accuracy of timer available, measured time period becomes 0 seconds. In this case, khornerstone can not be computed: therefore, giving 0 khorners as the result. Read 16Kb sequentially are reported as 0.000 seconds and 0.00 khorners, because files are cached by the dynamic allocation buffer in NEWS-OS Release 4.0C/R and the cache "hit" in this case.

*2 This value does not reflect the performance of this machine, and can not be compared with other obtained results. As explained before, some results are reported as zero, which in return affect the total values.

WSL Khornerstone tests, as described in other documentation. Khornerstone combines the results of 21 separate tests to achieve the khornerstone rating shown here. Both C and Fortran are required.

6.5 Data of Linpack Benchmark Test

table 6.5-1 results

Linpack				
	Unrolled BLAS		Rolled BLAS	
	double (Mflops)	single (Mflops)	double (Mflops)	single (Mflops)
NWS-711(CISC)	0.088	0.097	0.087	0.096
NWS-711(RISC)	0.088	0.097	0.087	0.096
NWS-721(CISC)	0.110	0.119	0.108	0.118
NWS-721(RISC)	0.110	0.119	0.108	0.118
NWS-821	0.091	0.099	0.090	0.098
NWS-841	0.091	0.099	0.090	0.098
NWS-891	0.091	0.099	0.090	0.098
NWS-921	0.139	0.156	0.136	0.153
NWS-1230	0.192	0.212	0.189	0.208
NWS-1250	0.192	0.213	0.188	0.209
NWS-1450	0.192	0.212	0.188	0.208
NWS-1460	0.191	0.212	0.188	0.208
PWS-1560	0.133	0.148	0.131	0.146
NWS-1750	0.196	0.221	0.192	0.215
NWS-1850	0.204	0.225	0.199	0.219
NWS-1860	0.204	0.225	0.199	0.219
NWS-1960	0.204	0.225	0.199	0.219
NWS-3260	1.856	4.578	1.907	4.905
NWS-3460	2.376	4.905	2.452	4.976
NWS-3720	2.452	4.905	2.452	4.940
NWS-3840	3.433	5.282	3.614	5.722
NWS-3860	3.433	5.282	3.468	5.722
NWS-3870	4.292	6.867	4.578	6.867

[Note] Machine names followed by ( ), indicate diskless machines.
For (CISC), use an NWS-1860 with main memory of 32MB as a server machine.
For (RISC), use an NWS-3870 with main memory of 128MB as a server machine.

6.6 Data of Livermore Fortran Kernels Benchmark Test

table 6.6-1 results (span = 167, Geometric Mean)

LFK Geometric Mean (span = 167)		
	double (Mflops/sec)	single (Mflops/sec)
NWS-711(CISC)	0.1003	0.1082
NWS-711(RISC)	0.1002	0.1082
NWS-721(CISC)	0.1235	0.1331
NWS-721(RISC)	0.1236	0.1332
NWS-821	0.1021	0.1102
NWS-841	0.1028	0.1109
NWS-891	0.1022	0.1102
NWS-921	0.1464	0.1609
NWS-1230	0.2031	0.2256
NWS-1250	0.2032	0.2255
NWS-1450	0.2029	0.2252
NWS-1460	0.2029	0.2252
PWS-1560	0.1513	0.1656
NWS-1750	0.2080	0.2309
NWS-1850	0.2162	0.2361
NWS-1860	0.2163	0.2363
NWS-1960	0.2164	0.2361
NWS-3260	2.3116	3.5563
NWS-3460	2.3211	3.6016
NWS-3720	2.4853	3.5923
NWS-3840	2.9894	3.8654
NWS-3860	2.9861	3.8719
NWS-3870	3.7332	4.8733

[Note] Machine names followed by ( ), indicate diskless machines.
For (CISC), use an NWS-1860 with main memory of 32MB as a server machine.
For (RISC), use an NWS-3870 with main memory of 128MB as a server machine.

For further information, please contact the following Sony offices and dealers.

USA

Sony Microsystems Company
645 River Oaks Parkway, San Jose, CA 95134, USA
Phone: (408) 434-6644 Fax: (408) 954-1057

Regional Sales Offices
645 River Oaks Parkway, San Jose, CA 95134, USA
Phone: (408) 434-6644 Fax: (408) 954-1057

3201 Premiere Drive, Suite 100, MD-6, Irving
TX 75063-3658, USA
Phone: (214) 550-5228 Fax: (214) 550-5300

Canada

Sony of Canada, Ltd.
New Business Development Division
411 Gordon Baker Road, Willowdale, Ontario, M2H 2S6 Canada
Phone: 416-499-1414 Fax: 416-497-1774
Telex: 6986861 (SOCAN MKTG TOR) (Address Code: WILSONY)

Europe

Sony Microsystems Europe (European Headquarters)
Bleriotstr. 1-3, 5000 Köln 30, Germany
Phone: (0221) 59 78 50 Fax: (0221) 59 35 42
Telex: 8883042

Benelux

Sony Microsystems Europe, Benelux Office
Sony Belgium S.A./N.V.
Rue de l'Aéronef 55, Luchtschipstraat 55, 1130 Brussel, Belgium
Phone: (02) 7 24 18 41 Fax: (02) 7 21 38 43
Telex: 61686 (61686 SOBEL B)

Denmark

Sony Microsystems Europe, Denmark office
Sony Scandinavia A/S
Hoersvinget 1, P.O. Box 154
2630 Taastrup, Denmark
Phone: (042) 99 5100 Fax: (042) 996151

France

Sony Microsystems Europe, France Office
Sony France S.A.
15 Rue Floreal, 75017 Paris, France
Phone: (1) 40 87 30 00 Fax: (1) 47 31 13 57

Germany

Sony Microsystems Europe
Sony Deutschland G.m.b.H.
Broadcast & Communication, Microsystems
Berner Str. 17, 6000 Frankfurt 50, Germany
Phone: (069) 5 09 10 90 Fax: (069) 50 91 09 33

Frauenhoferstr. 1, 8045 Ismaning, Germany
Phone: (089) 96 07 02 80/81/82 Fax: (089) 96 07 02 13

Austria

Sony Microsystems Europe, Austrian office
Sony Ges.m.b.H
Lexenburger Strasse 214
A-1232 Wien, Austria
Phone: (0222) 61051-213 Fax: (0222) 61051-8

Greece

Technologica LTD.
11 Vouliagmenis Ave., 11636 athens, Greece
Phone: (1) 9 02 40-55, -58, -64 Fax: (1) 9 22 80 16
Telex: 224415 GSC

Italy

Sony Microsystems Italia S.p.A.
Centro Direzionale Colleoni, Palazzo Perseo
Via Paracelso n. 10A, 20041 Agrate Brianza (Mi), Italy
Phone (039) 63 94 31 Fax: (039) 63 94 39

Netherlands

SIMAC Electronics b.v.
Divisie Sony Workstations
High Tech Park, 5503 HP Veldhoven, Netherlands
Phone: (040) 58 29 11 Fax: (040) 58 27 07 Telex: 51037

Portugal

COMPTA
Av. Fontes Pereira de Melo 14-11, 1100 Lisboa, Portugal
Phone: (01) 3 52 11 11 Fax: (01) 3 52 02 02 Telx: 18616

Spain

Sony Microsystems Europe, Spain Office
Sony España, S.A.
Carretera de La Coruna, km 17.8, 28230 Las Rozas (Madrid), Spain
Phone: (91) 636 10 00 Fax: (91) 637 29 90

Sweden

Sony Microsystems Europe
Scandinavian Branch Office (Sweden)
Ulvsundavegen 174 Bromma, Sweden
Mail address: S-161 85 Bromma, Sweden
Phone: (08) 7 33 61 00 Fax: (08) 98 26 55 Telex: 13810 (SONY S)

Switzerland

Sony Microsystems Europe, Switzerland Office
Sony (Schweiz) AG
Wagistrasse 6, CH-8952, Schlieren, Switzerland
Phone: (01) 733 33 11 Fax: (01) 730 47 30
Telex: 829077 (SONY CH)

United Kingdom

Sony Microsystems Europe, UK Branch Office
Sony U.K. Ltd.
SONY House, South Street, Staines, Middlesex TW-18 4PF, U.K.
Phone: (0784) 46 72 28 Fax: (0784) 46 32 78/46 37 01
Telex: 925671 (925671 SONY G)

Australia

Sony (Australia) Pty., Ltd.
33-39 Talavera Road, North Ryde, N.S.W. 2113, Australia
Phone: (02) 887-6666 Fax: (02) 887-4351 Telex: 24254

Korea

Daewoo Electronics Co., Ltd., Computer Headquarters
Domestic Market Division 3 Section 1
C.P.O. Box 8003, Seoul, Korea
Phone: (02) 757-8176, (02) 759-3804
Fax: (02) 756-2828, (02) 776-6669, (02) 752-9598

Singapore

Asian Computer Services Pte., Ltd.
10 Dundee Road, #07-01, Setron Building, Singapore 0314
Phone: 4755200 Fax: 4797872 Telex: RS 34131 ACS

Taiwan

Syntra Information System, Inc. (ShinLee Group)
6F, No. 2, Sec. 3, Pa-Teh Road, Taipei, Taiwan, R.O.C.
Phone: (02) 721-5942 Fax: (02) 772-1794

Headquarters (Japan)

International Sales Division
Super Microsystems Group, Sony Corporation
Gotanda AN Bldg., 1-22-1 Higshigotanda, Shinagawa-ku
Tokyo, 141 Japan
Phone: (03) 3448-4041 Fax: (03) 3448-4043
Telex: SONY CORP J22262

NEWS
NETWORK STATION

Sony Corporation