IBM

Personal Computer
Productivity Series

Cluster Program

Introduction and
Program Setup Guide

International Business Machines Corporation   Boca Raton, Florida 33432

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Cluster Program

Introduction and
Program Setup Guide

Organization of the Cluster Program Library

The library for the Cluster Program consists of four books:

- The Introduction and Program Setup Guide

  The *Introduction and Program Setup Guide* provides general information for all operators using the Cluster Program, such as definitions of new terms, descriptions of the Cluster Program files, and information for applications programming. It also contains instructions for the installation manager to make operational diskettes for each station in the cluster without a disk server station.

- The Disk Server Guide

  The *Disk Server Guide* contains information to install the Cluster Program files for clusters with a disk server station. It also explains how to configure the fixed disk at the disk server station and create the public volume, the remote system reset volume, and private volumes.

- The Public Volume Manager Program Guide

  The *Public Volume Manager Program Guide*
  presents material to maintain the public volume.
  The cluster manager uses this guide to manage and
  update the public volume.

- The Information Transfer Program Guide

  The *Information Transfer Program Guide* describes
  message and file transfer capabilities in the cluster.
  The station operators use this book to send and
  receive messages and files between stations.

About This Book

This book is the introduction and program setup guide
for the IBM Personal Computer Cluster Program.

- Chapter 1 provides a general overview of the
  product. You should read this chapter before using
  the Cluster Program and before reading the other
  books in this library.

- Chapter 2 tells you how to get your programs
  installed for clusters without a disk server station.
  This chapter includes a description of the Cluster
  Program files.

  The *Introduction and Program Setup Guide* also
  contains:

- Appendix A: Assembler Language Interface for the
  Cluster Program

  This interface is specific to the Cluster Program.
  Other products offering message and file transfer
  capabilities may use a different interface.

- Appendix B: Printing Documents

- Appendix C: Using IBM Communications Programs

- Glossary of Terms

Assumptions

This book assumes that a cluster has been designed and the hardware has been installed before you use this product.

This book also assumes that you are familiar with the IBM Personal Computer.

The Cluster Program runs under DOS, Version 2.1. You should be familiar with DOS and its commands before you use this program.

Related Publications

The following are related publications for this library:

- IBM Personal Computer *DOS Reference* manual, Version 2.1.

- IBM Personal Computer *Guide to Operations*

- IBM Personal Computer *Hardware Maintenance and Service* manual.

The *Introduction and Program Setup Guide* is a prerequisite for the other books in this library:

- *Disk Server Guide*

- *Volume Manager Program Guide*

- *Information Transfer Program Guide*

Machine Requirements

To operate the IBM Personal Computer Cluster
Program, certain machine requirements must be met.
The specific requirements for each type of Personal
Computer in the cluster are listed below.

IBM PC or PC-XT

Each IBM PC or PC-XT in the cluster requires the
following minimum configuration:

- One diskette drive

- At least one of the computers in the cluster must
  contain a dual-sided diskette drive

- 128KB of memory

- An 80-column display with an adapter

- An IBM Personal Computer Cluster Adapter

- The appropriate cables and connectors

- On the IBM PC only, a BIOS ROM module dated
  10/27/82 or later. The Personal Computer Cluster
  Adapter insert to the *Guide to Operations* contains
  information on how to find the ROM module date.
  Contact your dealer if you need a new ROM
  module.

IBM PC or PC-XT as a Disk Server Station

Either an IBM PC with an expansion unit or an IBM PC-XT can be used as a disk server station. Your cluster must have a disk server station if you want to use remote system reset and volumes. The following minimum configuration is required for a disk server station:

- 256KB of memory

- One dual-sided diskette drive

- An 80-column display with an adapter

- An IBM Personal Computer Cluster Adapter

- The appropriate cables and connectors

PC*jr*

Each IBM PC*jr* in the cluster requires the following minimum configuration:

- 128KB of memory

- An 80-column display

- An IBM PC*jr* Cluster Attachment

- The appropriate cables and connectors

The IBM PC*jr* Cluster Attachment may not work with some PC*jr* options. See your dealer for information on which options are supported.

Programming Requirements

To use the Cluster Program, you need:

- The Cluster Program diskette

- A DOS 2.1 program diskette

- At least two blank diskettes for backup and operational copies. Additional operational diskettes are required for each station in the cluster.

Each machine in the cluster must have DOS 2.1 active before running the Cluster Program.

IBM Personal Computer program license agreements permit the use of a program on a single machine. The customer is responsible for ensuring that each system user in the cluster is appropriately licensed to use any programs shared over the cluster.

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Chapter 1. Cluster Overview

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Introduction

This chapter provides general information and program setup for the IBM Personal Computer Cluster Program.

The Cluster Program allows IBM Personal Computers to be connected via coaxial cable. These computers form a cluster, supporting the transfer of messages and files between stations on the link.

The Cluster Program consists of three programs you can use:

- The Disk Configurator program

- The Public Volume Manager program

- The Information Transfer program

The Cluster Program runs under DOS 2.1, so you can use DOS commands to run applications as usual. The difference is that you can also be part of a cluster, sharing programs and data with other users on the system.

Cluster Performance Considerations

A cluster of IBM Personal Computers can contain up to sixty-four stations. However, you should keep in mind that in those clusters which will experience a great amount of I/O activity involving the disk server, performance could be affected as you add stations to the cluster.

The fixed disk can handle only one I/O request at a time, whether it comes from the disk server or a remote station. During periods of heavy I/O activity, some requests may have to wait to be processed. For example, if thirty stations requested access to the fixed disk at the same time, even with the electronic speed of a computer, the later requests would have to wait in line while the disk takes care of earlier requests. Of course, this is an extreme example, but it illustrates the fact that cluster performance tends to decline as the number of I/O operations increase. Since I/O activity will increase as the cluster gets larger, you will reach a point where cluster performance will be affected.

Therefore, if your cluster will be supporting a large number of I/O operations per station, you may want to limit the size of your cluster to ensure good performance. Or if you choose to have a large cluster, you will have to limit the number of I/O operations per station.

Another point to consider is that I/O requests issued to the fixed disk from the disk server station have a higher priority than remote station requests. For example, loading a large program at the disk server station will stop all remote station I/O requests for the duration of the load. This will affect the performance of the cluster. To avoid this, try to run programs at the disk server station which use minimal I/O activity.

Keyboard input at the disk server station may also be affected when many stations are using the disk server. For example, the 15-character keyboard buffer can fill and cause the alarm to beep on operator input. Try to minimize operator activity at the disk server station during periods of high remote station I/O activity.

What Clusters Do

Clusters allow IBM Personal Computers to be
connected for transferring information between
computers. These computers are also called *stations*.
Clusters can be set up with or without a disk server
station. If you have stations in the cluster without disk
drives, you must have a disk server station.

The following pages describe clusters with a disk server
station (the shared disk concept and volumes) followed
by a description of clusters without a disk server
station.

Clusters With a Disk Server Station

A disk server station allows each station to share a fixed disk.

The Cluster Program gives you more flexibility with the shared disk arrangement. For example, when you have a disk server, you can run applications using the volumes.

When stations share the same disk they can also share the same programs. A station in the cluster can load a program from the fixed disk. Other stations can load the same program without interference.

The following picture shows a cluster with a disk server station.

Disk server
station 01

Fixed
disk

Remote
station 02

Remote
station 03

Remote
station 04

Remote
station 05
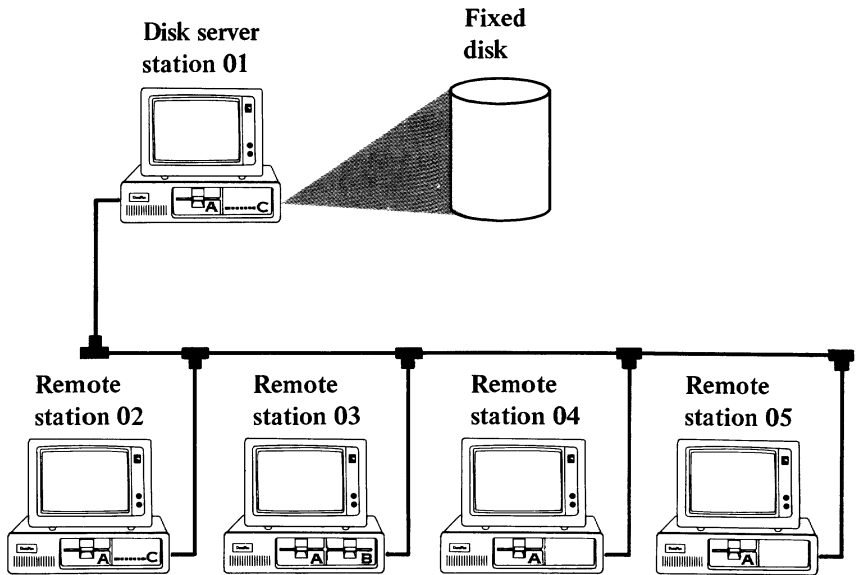
The Shared Disk Concept and Volumes

The disk server station must have a fixed disk. The fixed disk is divided into four areas:

- The first area contains a set of files called the *public volume*. All stations in the cluster can read the files on the public volume. A public volume is formatted like a fixed disk.

- The second area contains an optional *remote system reset volume*. This volume contains system files, Cluster Program files, and optional applications. It can be used by stations that do a system reset from the disk server station. The remote system reset volume is formatted like a diskette.

- The third area contains *private volumes*. Each station can own one private volume. Each private volume is formatted like a fixed disk.

- The fourth area is the unassigned portion of the fixed disk that has not been used for any of the volumes. This area can be used by the disk server station.

The following picture shows the four areas on the fixed disk at a disk server station.

Fixed
disk

Public
volume

Remote system
reset volume

Private volume 02

Private volume 03

Private volume 04

Private volumes

Unassigned
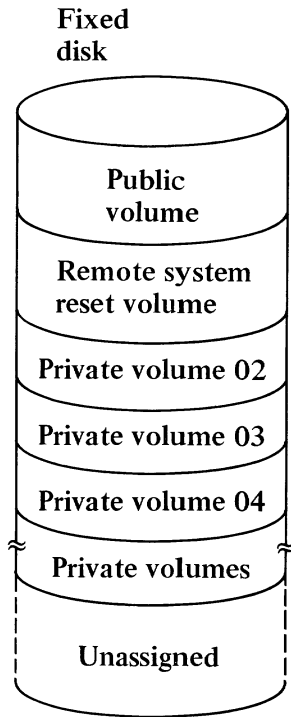
The Public Volume

Every cluster with a disk server has a public volume that is on the disk server station's fixed disk. Only one public volume can exist in the cluster. All the stations can share the information on the public volume. All stations can read, or copy, from the public volume. The cluster manager is the only person in the cluster who can write, or copy, to the public volume, using the Public Volume Manager program.

The Remote System Reset Volume

The remote system reset volume is optional. This volume allows stations without disk drives to do a system reset from the fixed disk at the disk server station. When stations start their system, they access DOS and other programs from this volume. Stations with disk drives also have the option of using this volume.

The following picture shows how a disk server can read these volumes.

Fixed disk

Disk server station 01	read only	Public volume
		Remote system reset volume
		Private volume 02
		Private volume 03
read/write		Private volume 04
		Private volumes
		Unassigned
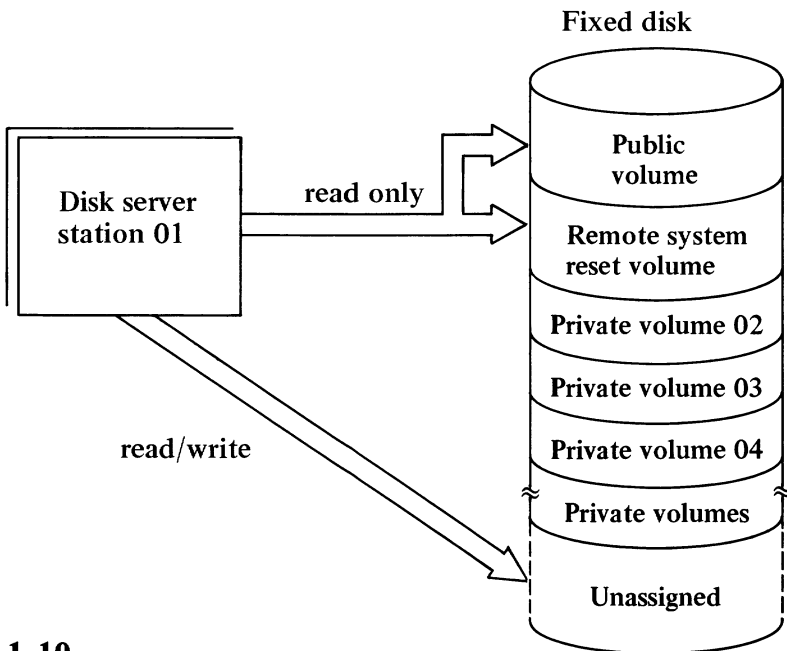
Private Volumes

A part of the fixed disk can also be a private volume. Each station in the cluster, except the disk server station, can have one private volume. A private volume is like having an additional diskette drive in your system. Station operators decide what files are on their private volume and who can use it.

The following picture shows how stations can use the volumes.

Fixed disk
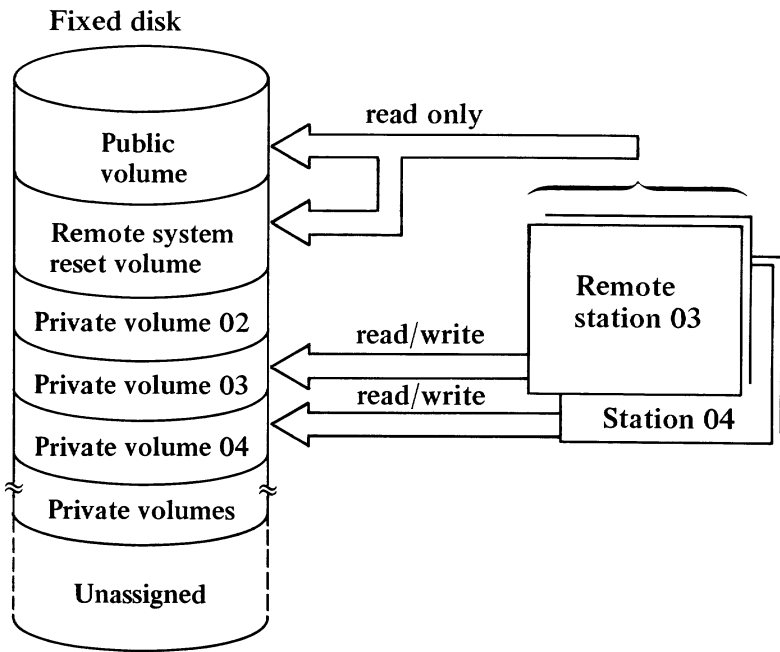
How to Use Volumes

The type of system reset you perform determines the drive letters for your volumes. A *system reset* is how you start or load DOS (Ctl-Alt-Del keys). Two types of system reset can be done: remote system reset and local system reset. When you load DOS from the remote system reset volume, you're doing a remote system reset. When you load DOS from your disk drives, it's a local system reset.

The link must be activated at the disk server station (by loading IT DISK) for remote stations to use volumes. If changes are made at the disk server station, you must restart DOS for the changes to be effective at your station.

You don't have to have any drives at your station to use the public volume, the remote system volume, and private volumes. If you do have drives, DOS treats these volumes as if they were additional drives.

> **Note:** The drive letter varies according to your configuration. See the Drive Letter Chart Appendix to determine the drive letters for each of the volumes. Then you must change the default drive or specify it in your commands.

How to Copy Files to Volumes

Files can be copied to the public volume and the remote system reset volume using the Disk Configurator program and the Public Volume Manager program. This can only be done from the disk server station and the volume manager station. Contact the cluster manager to have files copied to the public volume. The *Disk Server Guide* and the *Public Volume Manager Program Guide* contain a description of these procedures.

Several methods can be used to copy files to a private volume:

- You can use the DOS COPY command to copy files from a disk drive to a private volume.

- You can use Information Transfer to get files from a station's private volume or drive to your private volume.

- You can read files from the public volume and copy them to your private volume.

- You can run application programs, which create files in your private volume.

How Volumes are Assigned

The installation manager uses the Disk Configurator program to give each station access to the public and private volumes by making an entry in the *disk server station index*. The disk server station index is a listing of the stations on the link with their station number and the private volume size. The station number is determined by the switch settings on the Cluster adapter card when it is installed.

The installation manager decides which stations need private volumes and what size they should be before the cluster is configured. As cluster requirements change, the cluster manager can add or remove stations from the disk server station index.

Clusters Without a Disk Server Station

Clusters without a disk server station cannot have any volumes. However, they can still use Information Transfer to send and receive messages and files, and list file directories of other stations' drives.

The installation manager sets up the programs for stations to use the Cluster Program.

The following picture shows a cluster without a disk server station.

| Cluster program files | Cluster program files | Cluster program files | Cluster program files |
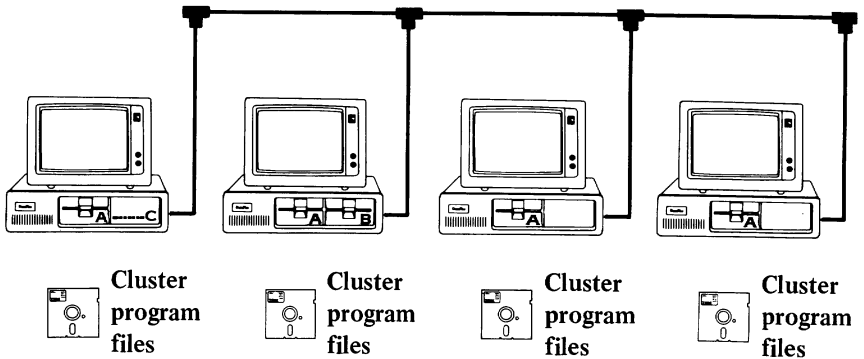
Who Uses the Cluster

The Cluster Program is used by: the installation
manager, the cluster manager, and the station
operators.

The Installation Manager

The installation manager uses (1) the *Introduction and
Program Setup Guide* to install programs for clusters
without a disk server station or (2) the *Disk Server
Guide* to install programs and configure the fixed disk at
the disk server station.

The installation manager responsibilities include:

• Installing the Cluster Program files for all types of
clusters

• Configuring the fixed disk

• Copying programs to the volumes on the fixed disk

• Making diskettes for all stations that need one

• Training the cluster manager in maintenance
procedures

The Cluster Manager

The cluster manager uses the *Disk Server Guide* and the *Public Volume Manager Program Guide* to manage and update the volumes after they have been created by the installation manager. This person is responsible for maintaining the cluster and copying files to the public volume.

> **Note:** The installation manager and the cluster manager can be the same person.

The Station Operators

Station operators use the *Information Transfer Program Guide* to transfer messages and files between stations on the link. They can also copy files from another station's private volume and read a station's file directory.

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Chapter 2. Program Setup

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Getting Started

Before you use the Cluster Program, you have to prepare your diskettes with the files to run the programs. The files you copy are determined by your cluster configuration.

Do you have a disk server station?

YES—Go to the *Disk Server Guide* for the procedures to set up the programs for a cluster with a disk server station.

NO—Complete the procedures given in the following pages.

This chapter contains instructions for:

- Making a backup (or duplicate) copy of the diskette shipped with the Cluster Program

- Formatting diskettes with DOS 2.1

- Copying the Cluster Program files to the formatted diskettes

Making a Backup Diskette

Use the DISKCOPY command to make a backup copy
of an entire diskette on another diskette. The diskette
is formatted during this copy procedure.

It is a good habit to backup the diskette shipped with a
product when you purchase it, then use the backup for
everyday operations.

What's Needed?

You will need:

- A DOS 2.1 program diskette

- The Cluster Program diskette

- A blank diskette that will become the backup

  Note: The Cluster Program diskette is dual-sided.
  When you make your backup copy, you must use a
  dual-sided diskette drive.

DISKCOPY Procedure

1. Insert the DOS program diskette in drive A.

   Make sure the DOS A> prompt is displayed.

2. Type:

   ```
   diskcopy a: b:
   ```

3. Press Enter ◄┘.

4. Follow the instructions on the screen.

   If you have one drive, DOS will treat it as both drive A and drive B. You must switch diskettes each time DOS tells you to exchange diskettes until you see the message that tells you the copy is complete.

   If you have two drives, insert the Cluster Program diskette in drive A and the blank diskette in drive B. You will not have to switch diskettes. You see the message that tells you the copy is complete.

   > **Remember:** The source diskette is the Cluster Program diskette that is shipped with the product. The target diskette will be the backup copy.

5. Put a write-protect tab on the backup diskette.

   You now have a backup copy of the diskette that was shipped with the Cluster Program. Label the backup diskette and use it for everyday operations. Store your original diskette in a safe place.

Formatting a Diskette

Use the FORMAT command to get a diskette ready to
receive information. FORMAT checks the diskette and
builds a directory to hold information about the files
that will eventually be written on it.

You need to use FORMAT only once per diskette.

What's Needed?

You will need:

• A DOS 2.1 program diskette

• The diskettes you want to format

You must format a diskette with the DOS system files
for each station in the cluster.

FORMAT Procedure

1. Insert your DOS program diskette in drive A.

   Make sure DOS is ready and A> is displayed.

2. Type:

   ```
   format b:/s/1
   ```

   This will format a diskette that can be used in
   either a single-sided or a dual-sided drive.

3. Press Enter ◄┘.

4. Follow the instructions on the screen.

   If you have one drive, DOS will treat it as both drive
   A and drive B. You must switch diskettes each time
   DOS tells you to exchange diskettes until you see
   the message that tells you the format is complete.

   If you have two drives, insert the diskette you want
   to format in drive B. You will not have to remove
   the DOS diskette from drive A. You will see the
   message that tells you the format is complete.

5. If you have more diskettes to format, type y. If not,
   type n. You do not have to press the Enter key.
   When you see the DOS prompt, A>, you can
   remove your newly formatted diskette. The diskette
   is ready to be used.

Format a diskette for each station in the cluster. Use
the CCOPY procedure on the following page to copy
your Cluster Program files to the formatted diskette to
be used as the operational diskette.

Copying Cluster Files to Your Diskette

The Cluster Program files are copied to your diskette
by a batch file called CCOPY.BAT This batch file
copies many files, or a group of files, at one time.

What's Needed?

You will need:

- The backup copy of your Cluster Program diskette

- The diskettes you formatted with the DOS system
  files

CCOPY Procedure

Make sure DOS is ready and **A>** is displayed.

1. Insert the Cluster Program diskette in drive A.

2. Type:

   ```
   ccopy b
   ```

3. Press Enter ◄┘ .

4. Follow the instructions on the screen.

   If you have one drive, DOS will treat it as both drive
   A and drive B. You must switch diskettes each time
   DOS tells you to exchange diskettes until you see
   the message that tells you the copy is complete.

If you have two drives, insert the diskette you want to copy to in drive B. You will not have to remove the Cluster Program diskette from drive A. You will see the message that tells you the copy is complete.

This procedure copies the following files to your diskette:

```
TBL.SYS      PLLSCR.COM    MSG.SYS
IT.COM       PDT.COM       RIODRV.COM
VM.COM       CONFIG.SYS    PCMDP.COM
```

Repeat this procedure or use the DISKCOPY procedure to duplicate the diskette for each station in the cluster. Do not write-protect the Cluster Program diskettes. Stations will not be able to receive messages or files if a write-protect tab is on the diskette. Inform the station operators that they are ready to use Information Transfer.

You have completed the program installation for a cluster without a disk server station.

Cluster Program Files

The Cluster Program is shipped on one diskette. Here is a short description of all the files on the diskette:

FILENAME   **DESCRIPTION**

CCOPY.BAT   This is a BAT file that is used to install the Cluster Program files. The Cluster Program diskette must be inserted into the default drive. Type **CCOPY X** or **CCOPY X DISK** to install the files. X is the target disk drive. The **DISK** parameter is for disk server station installation.

DC.COM   Disk Configurator program for the disk server station. DSERVER.TAB must be available in a root directory when this program is loaded and PLLSCR.COM must be in the root directory of the default drive.

DISK   This file is renamed to CONFIG.SYS during installation using CCOPY. The CONFIG.SYS has three functions that are executed at system reset time: (1) To set the maximum number of files that can be open to 30; (2) To load the public volume reader program (PUBLIC.COM); and (3) To set

the BUFFERS=3 parameter. CONFIG.SYS must be on the system reset drive.

DSCOPY.BAT   This is a BAT file for installation at the disk server station. This file is referenced by CCOPY X DISK.

DSE.COM   Disk Server Erase disk program. This file must be used from the disk server disk drive.

DSERVER.TAB   This file contains the default disk server station index. This file is pre-initialized and is copied as part of the installation procedure. DSERVER.TAB must be in the root directory of the disk server disk.

IT.COM   Information Transfer loader. This program requires the following files to be on the root directory of the default drive: MSG.SYS, PCMDISK.COM or PCMDP.COM, PDT.COM, PLLSCR.COM, and TBL.SYS. At the disk server station, this program requires RIPLPGM.COM to be in a root directory if remote system reset is supported.

MSG.SYS   This is a pre-initialized message file that is used by the Information Transfer program. This is one of the internal use files. MSG.SYS must be with TBL.SYS in the root directory.

PCMDISK.COM   Protocol command processor for the disk server station. This program is required by IT.COM to run on the disk server station.

PCMDP.COM   Protocol command processor for non-disk server stations. This program is used by IT.COM at a non-disk server station.

PDT.COM   Information transfer program.

PLLSCR.COM   This is the screen text and is required to be in the root directory of the default drive for IT.COM, DC.COM, and VM.COM.

PRTDEMO.BAT   Sample BAT file for explaining how to use a printer and the DOS print spooler with the Cluster Program.

PRT.BAS   Sample BASIC program used with PRTDEMO.BAT.

PUBLIC.COM   This is an I/O driver that is automatically loaded by DOS at system reset time. This program is loaded because the installation procedure renames the DISK file to CONFIG.SYS. This I/O driver allows read access to the public volume created by the Disk Configurator Program (DC.COM) at the disk server station. CONFIG.SYS must be on the system reset drive.

REMCOPY.BAT   This BAT file is used at stations that do a system reset from the disk server station. The BAT file copies and renames the files used by Information Transfer to allow it to run at stations without diskette drives.

REMOTE   This file is renamed to CONFIG.SYS during installation using CCOPY. This file is executed at system reset time: (1) To load RIODRV.COM, which allows the stations to have access to the disk server public and private volumes; and (2) To set the BUFFERS=3 parameter. CONFIG.SYS must be on the system reset drive.

REMOVE.BAT   This is a BAT file used at the disk server station to erase a temporary sub-directory created by DSCOPY.

RIODRV.COM   This is an I/O driver that is loaded by DOS at system reset time. This program is loaded because the installation procedure renames the the REMOTE file to CONFIG.SYS. This remote I/O driver allows access to the public volume, the station's private volume, and the remote system reset volume. See the drive letter chart for more information. The CONFIG.SYS file looks for RIODRV.COM on the system reset drive.

RIPL   This file is renamed to
                        CONFIG.SYS during installation
                        using CCOPY. This file is executed
                        at system reset time: (1) To load
                        @#CLUSTR.COM, which does the
                        final setup for RIPLPGM.COM,
                        and (2) To load RIODRV.COM,
                        which allows the stations to have
                        access to the disk server public and
                        private volumes. CONFIG.SYS
                        must be on the system reset drive.

RIPLPGM.COM   This is a program that is resident at
                        the disk server station. The
                        program is used by stations that do
                        a system reset from the disk server
                        station. This program is
                        automatically sent across the link
                        and resides at the remote station.
                        The program uses the remote
                        system reset volume at the disk
                        server station.

TBL.SYS   This is a pre-initialized file that is
                        used by the Information Transfer
                        program. This file is used for
                        various functions, such as station
                        options, drive access information,
                        and the Information Transfer
                        station index. This is one of the
                        internal use files. TBL.SYS must
                        be with MSG.SYS in a root
                        directory.

VM.COM   Public Volume Manager program.
                      This program requires that both the
                      RIODRV.COM I/O driver and the
                      IT.COM program be loaded prior
                      to use. PLLSCR.COM must also
                      be available in the root directory of
                      the default drive.

@#CLUSTR.COM

                      This is a device driver that is loaded
                      by DOS at system reset time. This
                      program is loaded because the
                      installation procedure renames the
                      RIPL file to CONFIG.SYS on the
                      remote system reset diskette. This
                      device driver completes the remote
                      system reset process by moving
                      RIPLPGM.COM to its correct
                      place in memory as a part of DOS.

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Appendixes

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Appendix A. Assembler Language Interface for The Cluster Program

You can write programs to be used in the foreground to gain access to the Cluster Program to (1) copy files from a station, (2) send files to a station, or (3) send messages to a station. This interface is specific to the Cluster Program. Other products offering message and file transfer capabilities may use a different interface.

This Assembler Language interface has the following calling sequence:

1. The link must be activated using Information Transfer.

2. The register pair, BX:ES, must contain the address (offset:segment) of a parameter control block (PCB). The PCB structure and content descriptions are included in this section.

3. Execute interrupt X'5B' to transfer control to the Cluster Program. (Type **INT 5BH** for the macro assembler.)

All registers are preserved except AX. Register AL contains the return code. A zero return code is a good return and a non-zero return code is an error. Return codes are also described in this section.

The Cluster Program must be loaded and initialized by
the loader provided with the Cluster Program. In
addition, any option changes must be done using the
Information Transfer program before loading the user
program.

The Cluster Program uses the foreground program
stack, so you must make sure that the foreground stack
contains enough space for both foreground and
background programs.

PCB Structure and Content for Get-Send Files

PCB STRUCTURE AND CONTENT FOR GET–SEND FILES		
DATA	**BYTES**	**VALUE**
Command	1	X'02' for Send File; X'03' for Get File
Destination Node	1	X'00' to X'3F' (0-63 decimal)
Reserved	1	N/A
Source File Specification Pointer	4	offset:segment
Destination File Specification Pointer	4	offset:segment

- **Command**— Self-explanatory.

- **Destination Node**— This is the remote node that is receiving the file (when you use send file) or sending the file (when you get a file). The value must be in the range of X'00' to X'3F' (0-63 decimal).

- **Source File Specification Pointer**— This is the address, offset and segment, of the file specification for the file you are copying. It must be a valid DOS file specification with drive, directory path (if necessary), and filename. It must end with X'00'. The filename cannot be MSG.SYS, because this name is reserved for the Cluster Program and an error will result if you try to copy it.

- **Destination File Specification Pointer**— This is the address, offset and segment, of the file specification for the receiving file. It must be a valid DOS file specification with drive, directory path (if necessary), and filename. It must end with X'00'. If the file already exists at the remote station (when sending a file), you will get an error.

ERROR CODE	MEANING
X'01'-X'12'	DOS error codes. (See the *DOS Reference* manual.)
X'1E'	No space in directory
X'1F'	No space on disk
X'20'-X'2C'	These error codes are equivalent to the DOS critical errors X'00'-X'0C'
X'30'	Link initialization failed
X'31'	Link always busy
X'32'	Duplicate node
X'33'	No response from destination
X'34'	Too many frame rejects
X'37'	Info. field too long
X'38'	No info. field
X'39'	Link control command in program
X'3A'	Initialization needed
X'3B'	No frame received
X'3C'	Adapter card (hardware) error
X'3D'	Diagnostic error
X'3E'	Invalid command

X'51'	Frame length error
X'52'	Remote node busy
X'53'	Attempt to copy MSG.SYS
X'54'	File already exists
X'55'	Drive access denied
X'56'	Directory not found
X'58'	Device error
X'59'	No drive in filename
X'5A'	Disk free space comp. error
X'5B'	Timeout
X'5C'	Link error
X'5D'	Remote file empty
X'5E'	Invalid drive number
X'60'	Invalid command
X'62'	No adapter card
X'63'	Invalid node address
X'6E'	No remote system reset volume
X'6F'	Cannot write to remote system reset volume

X'70'	No public volume found
X'71'	Private volume has been erased
X'72'	No public volume write access
X'73'	Disk server busy
X'74'	Not authorized to run Public Volume Manager
X'75'	No private volume
X'76'	Response frame too long or invalid station address
X'77'	No response from disk server
X'78'	No room left in disk server volume
X'79'	Hardware error on disk server station
X'7A'	Frame reject
X'7B'	No response from the remote station
X'7C'	No station index found
X'7D'	Bad station index
X'7E'	No remote IPL program
X'7F'	DOS error opening or reading station index

All return codes should be examined for the high-order bit (X'80') status. If the high-order bit is on (1), the error occurred at the remote station. If the high-order bit is off (0), the error occurred at the local station.

PCB Structure and Content for Sending Messages

PCB STRUCTURE AND CONTENT FOR SENDING MESSAGES		
DATA	BYTES	VALUE
PCMDP Command	1	X'01'
Destination Node	1	X'00' to X'3F' (0-63 decimal)
Alternate Node	1	X'00' to X'3F' (0-63 decimal)
Message Length	2	Number of bytes in message (Hex value stored in Lo-Hi order)
Message Address	4	offset:segment

To broadcast a message to all stations on the link, the destination node must be X'FF'.

If you do not want to redirect a message to an alternate station when the message cannot be sent to the destination node, the alternate node must be X'FF'.

Message Receive

The message receive function runs in the background while a program is running in the foreground, so user interface is not required. When a message is received by the Protocol Command Processor (PCMDP) background program, it is placed on MSG.SYS at that station.

Message Format

A message is a string of characters up to 512 bytes. This is the maximum number of bytes that can be transferred over the link within one frame after protocol control information has been appended.

The message is stamped with the date and time by the receiving station and control characters are added before being placed on the message file (MSG.SYS). The format of a message is in the following table.

MESSAGE FORMAT			
	FIELD	BYTES	VALUE
*	Start of Header	1	X'0'
*	Message Length	3	0-512 (ASCII Value for Decimal Number)
*	Source Node (Node that sent the message)	2	0-63 (ASCII Value for Node Address)
*	Month	2	1-12 (ASCII Value)
*	Day	2	1-31 (ASCII Value)
*	Year	4	1980-2099 (ASCII Value)
*	Hours	2	0-23 (ASCII Value)
*	Minutes	2	0-59 (ASCII Value)

MESSAGE FORMAT			
	FIELD	**BYTES**	**VALUE**
*	End of Header	1	X'0D'
		1	X'0A'
	Message Text	1-512	
*	Trailer	1	X'0D'
		1	X'0A'

* is added at the receiving station.

Registers AH and AL will reflect the return status of the message transfer, since messages can be sent to either of two stations. The register contents are:

AL	AH	STATUS
0	0	Message received at destination node.
0	Error	Error at destination node. Message received at alternate node.
Error	0	Error at destination node. Alternate node was not requested. Message was not received.
Error	Error	Error at both the destination node and the alternate node. Message was not received.

The return code for broadcast messages (destination node is X'FF') will always be zero.

Appendix B. Printing Documents

The Cluster Program diskette contains a sample file, PRTDEMO.BAT. This sample shows how to use a BASIC program with the DOS print spooler.

> **Note:** This sample program may not work with all applications. You can tailor this for your particular needs.

If you have a printer in your cluster that you want to share with others, you can dedicate a printer to print documents for anyone in the cluster. You should do this printing at a station other than the disk server to avoid cluster performance degradation.

To use the sample program:

1. Make a diskette that has (1) DOS system files, (2) BASIC.COM, and (3) PRINT.COM (the DOS print spooler).

2. Copy the sample file, PRTDEMO.BAT, and the BASIC program, PRT.BAS, to this diskette from the Cluster Program diskette.

3. Activate the link using the Information Transfer program.

4. Give write access to the default drive.

5. End the Information Transfer program and keep the link active.

6. Type **PRTDEMO** to run the sample program.

The sample file (PRTDEMO.BAT) will look for files sent to your station's default drive that need to be printed. Then the file(s) will be sent to the DOS print spooler.

Any station in the cluster can send programs to be printed. The requirements are that the files:

* Be named with the extension PRT, and

* Be sent to the root directory of the default drive.

With the BAT file, three programs run simultaneously. The print spooler and the Cluster Programs are running in the background while the BASIC program is running in the foreground.

PRTDEMO.BAT and the BASIC program will run continuously and do not need user intervention after they are started except to reload the printer with paper.

The BAT file renames the files and gives them to the print spooler. When the file is sent to the print spooler, it is renamed with the extension PPP. The BASIC program is used to monitor the print spooler's progress. Both the BAT file and the BASIC program run continuously. After the file is printed, it is erased from this station.

The BAT file calls the BASIC program and goes into a timing loop. The BASIC program waits until the entire file is received before it is printed and deletes the files after they are printed.

Appendix C. Using IBM Communications Programs

You can use your Cluster programs at the same time you are using the IBM Communications Programs. The programs you can use are :

- *Asynchronous Communications Support, Version 2.00* (6024032)

- *Binary Synchronous 3270 Emulation* (6024037)

- *SNA 3270 Emulation and RJE Support, Version 1.00* (6024036)

- *IBM 3101 Emulation Program* (6024042)

All four communications programs are used similarly. The link must be activated by the Information Transfer program. If the Remote I/O Driver (RIODRV.COM) is loaded to gain access to the disk server volumes, these volumes can also be used for input or output. After the link is activated and the Cluster Programs are loaded, the communications programs are used normally.

Additional requirements for these programs are:

- The machine must have a minimum of 256K of memory.

- You must patch the SNA programs with DEBUG.

The patches for SNA 3270 Emulation and RJE Support follow.

The patch for SNA RJE Support is:

1. Type **DEBUG SRJEU.COM**

2. Press Enter ⬅ .

3. Type **E 45B**

4. Press Enter ⬅ .

5. This is displayed: 10

6. Type **30**

7. Press Enter ⬅ .

8. Type **W**

9. Press Enter ⬅ .

10. Type **Q**

11. Press Enter ⬅ .

The patch for SNA 3270 Emulation is:

1. Type **DEBUG 3270U.COM**

2. Press Enter ⬅ .

3. Type **E 433**

4. Press Enter ⬅ .

5. This is displayed: 10

6. Type **30**

7. Press Enter ⬅ .

8. Type **W**

9. Press Enter ⬅ .

10. Type **Q**

11. Press Enter ⬅ .

Notes:

Glossary

access. The manner in which files are used by the computer.

access mode. A method that determines how a file is used by stations on the link. The modes are: no access, read-only, write-only, and read/write.

activate. To start, or initialize, a program.

address. An address is a number specifying a station in the cluster.

alternate station. The station that receives a message when it is not received by the specified station. The alternate station is an option specified by the sender of a message.

background program. A program that performs its functions while the operator is working with a second, different program. For example, background programs can receive messages and files while the operator is running a program in the foreground.

BIOS. Basic Input Output System

broadcast. Sending a message to all stations in the cluster.

cluster. Two or more IBM Personal Computers connected to each other by coaxial cable with supporting software.

coaxial cable. An electrical-transmission cable with a center conductor and an outer electrical shield.

default. The default value of a setting is the original one, which is in effect until other instructions are entered.

directory path. A file specification parameter that defines the direction to get to a sub-directory. A backslash (\ ) defines the root or main directory of a file and separates sub-directory names.

disk server station. The station in the cluster with the fixed disk containing the public volume, remote system reset volume, and private volumes.

disk server station index. A listing of the stations in the cluster with the station number and the private volume size.

field. A position within a message frame.

files. Groups of related information on a disk.

file directory (DIR). A listing of files on a drive.

file specification. The drive specifier, the directory path, the filename, and the extension for a filename. The file specification allows DOS to locate a file. The drive specifier can be omitted if the file is on the default drive.

foreground program. (1) A type of system operation that is perceived by the operator to execute immediately at that station. (2) The opposite of background program.

internal use files. MSG.SYS and TBL.SYS are the internal use files for the Information Transfer program. These files are updated each time someone sends you a message or when you make changes to your station index, device access, or bell signal. These files must be together in the root directory on any drive.

link. The physical connection of IBM Personal Computers by coaxial cable.

message file. MSG.SYS is the Cluster Program message file. It is one of the internal use files.

message log. A short list of messages in the message file, MSG.SYS.

path. See directory path.

PCB. Parameter control block.

protocol. A set of rules governing the transmission of information over a data channel.

private volume. An area on the fixed disk containing files that belongs to an individual station.

public volume. An area on the fixed disk containing files that can be read by all stations that are listed in the disk server station index.

remote station. An IBM Personal Computer in the cluster that is not the disk server station.

remote system reset volume. An area on the fixed disk containing files to allow stations to system reset from the disk server station. This volume contains Cluster Program files, system files, and optional applications.

screen text file. PLLSCR.COM is the Cluster Program screen text file.

session. An interconnection between two stations for the purpose of transferring information.

station. See remote station.

station name. The name defined by an operator for a station. This name can be used in place of the station number to send messages and files, if it's listed in the station index.

station number. The number of a station in the cluster. This is the hardware address determined by the switch settings on the Cluster adapter card. Each station has a unique number between 0 and 63.

station index. An optional list of stations used in the Information Transfer program. Any station other than the disk server can create their own station index, equating a station name to a station number.

system reset. (1) The method for starting, or initializing, a program. When your computer is already ON and you want to restart it, press and hold the Ctl and Alt keys, then press the Del key. This is also called an Initial Program Load (IPL). Two types of system reset can be done: from the diskette drive at your station or from the fixed disk at the disk server station.

volume. (1) An area on the fixed disk where files are stored. (2) See public volume, private volume, and remote system reset volume.

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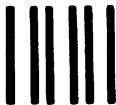authorized IBM Personal Computer dealer.

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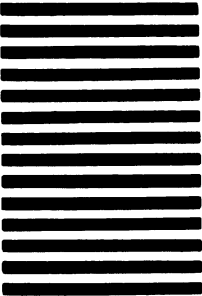
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