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NETNews distributes up-to-the-minute technical information about Microsoft networking software. Copies of this publication are also available on SmartPages. Please send suggestions and comments to Dan Shelly.

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News You Can Use

By Dan Shelly, Corporate Technology Team

Welcome to the May/June edition of *NETNews* for 1993. This spring has been extremely busy for the Corporate Technology Team. We didn't forget you, but creating and delivering Microsoft Windows NT Inside Track training kept us from publishing our March/April issue. The good news is that we are now back and ready to continue delivering technical information to help you better use Microsoft's networking products. Perhaps even better news is that every issue of *NETNews* will now be included on Microsoft's new TechNet CD. So if you are looking for a sure way of receiving every issue of *NETNews*, you should sign up for TechNet today! The most exciting news of course is that as this issue heads off to press, we are heading off to the launch of Windows NT. So you can look forward to a continued series of articles on various aspects of the Windows NT operating system in the months to come.

As always, if you have any suggestions, comments, or an article that you would like to submit for publication, please feel free to contact us at:

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A special thanks this month to Shawn Aebi who submitted an article on Microsoft SQL Server Administration.

Under the Bonnet

By Glen Clark, Corporate Technology Team

This month we will be looking at the major components in the networking architecture and how they interoperate.

A significant difference between the Microsoft Windows NT operating system and OS/2 1.x and even 2.x is that networking capabilities were built into Windows NT at the ground level. With MS-DOS, Windows (except for Windows for Workgroups), and OS/2, networking was added on top of the operating system. This meant that the NOS (Network Operating System) designers for Windows NT had the opportunity to design their components within the context of an operating system platform which was still being defined. It also meant that the network team did not have to duplicate the efforts (or code) of the kernel team, and vice versa.

The original designers had three things in mind. First, Windows NT should provide integral, application-transparent networking services. Basic file and print sharing and using services should be part of every Windows NT machine. Second, Windows NT should provide a platform for distributed applications. Application-level interprocess communication (IPC) should be provided for the development of client/server-type applications. Third, the designers recognized that the network market was enormous and growing larger. Windows NT should provide an expandable platform for other network components. All of these goals were to be met within the context of the other major goals of Windows NT, such as portability and security.

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Figure 1

To understand networking on Windows NT, we need to understand the architecture. As

with other architecture components of Windows NT, the networking architecture is built of layers. This helps provide expandability—for others to add functions and services. We are going to look at the model from the bottom up. The layered architecture used by Windows NT mirrors the OSI reference model quite well. The presentation layer is thin to non-existent, depending on the protocol and system used, however.

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Figure 2

At the bottom of the networking architecture is the network adapter card device driver. Windows NT currently supports device drivers written to Network Device Interface Specification (NDIS) 3.0. NDIS 3.0 is based on NDIS 2.0, which was the standard used by OS/2 NDIS device drivers. NDIS 3.0 conforms to the device driver standards established for Windows NT. There is a C-call interface; drivers have access to the helper routines; and drivers are 32-bit, portable, and multiprocessor safe. By providing a standard interface, NDIS permits the high level protocol components to be independent of the network interface card.

Unlike previous NDIS implementations, Windows NT does not need a PROTMAN (Protocol Manager) module to link the various components at each layer. This is accomplished through the information in the Registry and a small piece of code, or wrapper, around all of the NDIS device drivers. The NDIS wrapper provides a uniform interface between protocol stack drivers and NDIS device drivers. It also contains supporting routines which makes the development of an NDIS driver easier.

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Figure 3

Above the NDIS wrapper are the transport protocol device drivers (see Figure 3). Windows NT ships with three transports. NetBEUI provides compatibility with existing LAN Manager, LAN Server, and MS-Net installations. Transmission Control Protocol/Internet Protocol (TCP/IP) provides a popular routable protocol for wide area networks. And Data Link Control (DLC) provides an interface for access to mainframes and printers attached to networks.

The DLC protocol is not a full transport protocol by OSI definitions. Its top interface is at the data link control (DLC or, in IEEE terms, the Link Layer Control (LLC)) layer. DLC is used for fast, simple connection and connectionless conversation. The DLC protocol is used to communicate with network attached printers such as the HP II Si and to communicate with some mainframe computers. It is not possible to establish a client/server or peer-to-peer type session—for file sharing and using, for example—over the DLC protocol alone.

The NetBEUI protocol is provided with Windows NT to maintain connectivity to existing LAN Manager and MS-Net-based networks. The NetBEUI protocol is fast, with low overhead (number of extra bytes) per frame of data transmitted. The protocol cannot be routed, however. Thus, NetBEUI is most appropriate in single sub-net (continuous network) networks.

μ §*Figure 4*

When we talk about NetBEUI it is important to understand that we are talking about the transport layer protocol, not the programming interface NetBIOS (see Figure 4). Earlier implementations on MS-DOS and OS/2 provided the programming interface as part of the transport's device driver. There is nothing wrong with that, but in the Windows NT implementation we have separated the programming interface (NetBIOS) from the transport protocol (NetBEUI) to increase flexibility in the layered architecture. Separating the two allows us to use the same NetBIOS driver code for multiple transports such as NetBEUI and TCP/IP.

 μ §*Figure 5*

Finally, we want to look at TCP/IP (Figure 5). TCP/IP is implemented slightly differently from what we have seen with NetBEUI or DLC. Instead of being a single device driver bound directly to the NDIS device driver, TCP/IP resides "inside a wrapper." This wrapper is called Streams (or the Streams driver). Calls to the TCP/IP transport protocol driver must first go through the upper layer of the Streams device driver, and then to the NDIS device driver via the lower end of the Streams device driver.

Streams is a significant departure from the way protocol stacks were developed for MS-DOS and OS/2. There are several reasons for the use of the streams mechanism. Streams makes it easier to port existing protocol stacks to Windows NT. Streams also encourages protocol stacks to be organized in a modular, stackable style, thus moving closer to the original vision of the Open Systems Interconnection (OSI) model.

The Transport Driver Interface (TDI) provides a common interface for file system and I/O manager processes to communicate with the various network transports. It is a very "thin" layer. There is little code actually involved with the TDI. The TDI interface is based on 32-bit-wide handles. This increases the connection capacity between upper layers and protocols such as NetBEUI which traditionally only allows an 8-bit-wide handle (LSN - Local Session Number). The previous edition of *NETNews* contained detailed information on how the TDI is used to break the 255 session barrier.

The first design goal of the networking system is to support file and print sharing and using. This is accomplished by two modules, LANMANWorkstation and LANMANServer. These two components, with the help of several more we will identify,

provide most of the functionality of the OS/2 version of LAN Manager available today. Both of these modules execute as 32-bit services.

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Figure 6

The LANMANWorkstation module is really in two pieces (see Figure 6). The LANMANWorkstation component provides the user-mode interface. The other component is the RDR, or Redirector. This component is a File System Driver (FSD) that actually does the interaction with the lower layers of the protocol stack.

Multiple UNC (Universal Naming Convention) Provider (MUP) is an interesting entity that runs in kernel-mode memory. The most productive way of thinking of MUP is as a resource locator. The types of resources it locates are UNC names. A UNC name is a naming convention for describing servers, and sharepoints on those servers, on a network. UNC names start with two backslashes (\\) followed by the server name. All other fields in the name are separated by a single backslash (\). A typical UNC name would appear as:

`\\server\share\subdirectory\filename`

Not all of the components of the UNC name need to be present with each command. `\\server` is sufficient to find a server to get a list of its sharepoints.

Unlike the NDIS and TDI boundary layers, MUP is actually a program. NDIS and TDI simply define ways for a component on one layer to communicate with another over specifically defined paths called binds. MUP, too, has defined paths to redirectors or, as the name implies, UNC providers. The problem is that for any UNC name, MUP is not sure which of potentially many different UNC providers the command should go to.

MUP receives commands from applications that contain UNC names. If this is a UNC name that MUP has not seen in the last 15 minutes, it will send the UNC name to each of the UNC providers that are registered with it. This is why MUP is a prerequisite of LANMANWorkstation. One of the first tasks the LANMANWorkstation did when initializing was register with MUP. The redirector with the highest registered priority response that claims it can establish a connection to the UNC, will be passed the command and the security context of the application generating the request.

One might ask, why a MUP? LANMANWorkstation is the only UNC provider. This is true today. Recall, however, that one of the major design goals for networking in the Windows NT environment was to build a platform upon which others can build. MUP is a vital part of allowing multiple redirectors to co-exist in the machine at the same time.

LANMANServer is much like the LANMANWorkstation module. It is a service that

runs in the lmsvrcs process. Unlike the workstation component, it is not dependent on the MUP service, since the server is not a UNC provider. It doesn't attempt to connect to other machines, but it is connected to by other machines. Like LANMANWorkstation, it is composed of two parts: the LANMANServer component and the SRV component. The SRV component handles the interaction with the lower levels and also directly interacts with the other file system devices to satisfy command requests such as file read and write.

In addition to the workstation and server services from LAN Manager, a number of other services were ported over. These are: the Alerter, the Messenger, the Browser, and the Replicator. The Alerter is used to forward alerts generated on the local machine to remote computers or user names. The Messenger receives messages and alerts, and displays them on the screen in the form of a message box. The Browser is used to collect information about the machines in this domain or workgroup, and to inform users of these facilities when asked. The information collected by this facility is most obvious in the File Manager when attempting to connect to a new drive. Finally, the Replicator service permits the automatic copying of a directory from one machine to another. The source of the data is said to be on an export machine while the target is an import machine. A Windows NT Advanced Server can be either an export machine or an import machine, or both simultaneously. A Windows NT Server can only be an import machine.

So far we have built up to the redirector and server levels, and accomplished almost all of the design goals. One piece remains, however. Above the redirector and server components live the applications. Like our other layers, we want to provide them with a single unified interface to develop to, independent of the lower-layer services. This is done through two mechanisms. We have already looked at the first—MUP. The other is the MPR, or Multi-Provider Router. Applications that make I/O (Input/Output) calls that contain UNC names are directed to the MUP, where the appropriate UNC provider or redirector is located.

The MPR is much like the MUP. This layer takes in WNet commands, finds the appropriate redirector based on the handle, and passes the command to that redirector for communication onto the network. In addition to I/O calls such as Open and Close, Win32 contains a set of APIs called the WNet API. These are APIs that were ported over from Windows 3.1 network calls. Most of these calls deal with establishing remote connections. With these commands and the standard I/O commands, an application can do almost all of the networking functions needed.

The goal of distributed computing is to divide the computing task into two sections. One section runs on the client's workstation, something that may not take a great deal of computing power but would require a lot of network bandwidth. This section includes operations such as screen graphics, mouse movements, and keyboard functions. The other section of the process requires large amounts of data, number crunching, or specialized hardware. This section includes operations such as database lookups and updates, or mainframe data access. Central to the theme is that there is a connection between the client and the server at a process-to-process level that allows data to flow in both directions. There are a number of different ways to establish this conduit; we are going to discuss the six different mechanisms that Windows NT provides.

The six IPC mechanisms provided by Windows NT are: named pipes, mailslots, NetBIOS, Windows Sockets, Remote Procedure Calls (RPC), and Network Dynamic Data Exchange (NetDDE). Named pipes and mailslots provide backward compatibility with existing LAN Manager installations and applications. This is also true of the NetBIOS interface. Windows Sockets is a Windows-based implementation of the widely used sockets programming interface created by the University of California at Berkeley. RPC is compatible with the Open Software Foundation/Distributed Computing Environment (OSF/DCE) specification for remote procedure calls. NetDDE allows standard DDE connections to be redirected across the network as was possible with Windows for Workgroups.

Named pipes and mailslots are implemented slightly differently than the other IPC mechanisms. They are actually written as file systems (FS). Thus, in the Registry you find an MSFS and an NPFS. As file systems they share common functionality with the other file systems, such as security. In addition, local processes can use named pipes and mailslots with other processes on the local machine without going through the networking components. Remote access to named pipes and mailslots, as with all of the file systems, is accomplished via the redirector.

Named pipes are based on the OS/2 API set. Most of the calls, however, have been ported to the Win32-based API set. Additional asynchronous support has been added to the named pipes to make support of client/server applications easier. Because named pipes is a standard file system, it can take advantage of the cache manager. This can be used to improve the performance of certain types of named pipe applications. Specifically, the cache can be used with character mode pipes to buffer "outbound" traffic for a number of characters or a number of seconds. This can improve performance by reducing the number of frames (and network overhead) generated.

A new feature added to named pipes is "Impersonation." In impersonation the server can change its security identity to that of the client on the other end. This is done with the `ImpersonateNamedPipeClient()` API. Assume you have a database server system that uses named pipes to receive read and write requests from clients. When a request comes in, the database server program can impersonate the client before attempting to perform the request. So even if the server program does have authority to perform the function, the client may not, and the request would be denied.

The mailslot implementation in Windows NT is not the full OS/2 LAN Manager implementation. Where in LAN Manager there are first- and second-class mailslots, in Windows NT only second-class mailslots exist. Mailslots provide connectionless messaging, basically broadcast messaging. Delivery of the message is not guaranteed, although the delivery rate on most networks is quite high. It is most useful for discovering other machines or services on a network, or for wide-scale notification of a service. The use of mailslots should be contained as much as possible, however. Each mailslot transmitted is received by each machine on the local area network and processed at least to the degree that determines if the message is to be received or not. This can cause workstations to slow down. In addition, applications designed using mailslots are probably limited to local area network implementations only, since most wide area networks do not propagate broadcast messages across bridges or routers.

The use of NetBIOS as an IPC mechanism has been around since the introduction of the interface in the early 1980s. From a programming aspect, however, higher-level interfaces such as named pipes and RPC are superior in their flexibility and portability. The NetBIOS entry in the Registry defines a common interface point for multiple possible transport protocol providers.

The sockets interface for TCP/IP was created by the University of California at Berkeley in the early 1980s. Since then it has become a very popular interface for developing distributed applications in the TCP/IP and UNIX environments. Microsoft, in cooperation with several other software vendors, developed the Windows Socket API set to accomplish two things: (1) to migrate the sockets interface into the Windows and Windows NT environments, and (2) to help standardize the API set for all platforms. The Windows Socket interface for Windows NT is a layer above the TCP/IP.

The RPC mechanism is unique in that it uses the other IPC mechanisms to establish communications between the client and the server. RPC can use named pipes, NetBIOS, or TCP/IP Sockets to communicate with remote systems. If the client and server are on the same machine, it can use the LPC (Local Procedure Call) system used to transfer information between processes and subsystems. This makes RPC the most flexible and portable of the available IPC choices.

Much of the original RPC work was started by the SUN computer company and carried forward by the Open Software Foundation (OSF) as part of their Distributed Computing Environment (DCE). The Microsoft RPC implementation is compatible with the OSF/DCE standard RPC. It is important to note that it is compatible but not compliant. Compliance in this situation implies that one started with the OSF source code and worked forward. For a number of reasons, Microsoft-developed RPC started with the OSF specification but not the source code. The RPC mechanism is completely interoperable with other DCE-based RPC systems such as the ones for HP® and IBM®/AIX® systems.

Looking at how RPC works, we first need to understand what RPC is attempting to accomplish. A program can be viewed as having a “backbone” and a series of “ribs” spanning off the backbone. The backbone is the mainstream logic of the program, which

should rarely change. The ribs are the procedures the backbone calls on to do work or functions. This is simply another way of looking at “structured” programming. In traditional programs, the ribs were “statically” linked to the backbone—that is, they were linked and stored in the same executable module.

With OS/2 and Windows, the concept of Dynamic-Link Libraries (DLLs) is used. With DLLs the procedure code and the backbone code are in different modules. This allows the DLL to be modified or updated without changes to or redistribution of the backbone modules.

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Figure 7

RPC takes the concept one step further and places the backbone and the ribs on different machines. Doing this raises a lot of issues, such as data formatting, integer byte ordering, locating the server that contains the function, and establishing the communications mechanism being used (see Figure 7).

When put together we have RPC. The client application was developed with a specially compiled “stub” library. The client application thinks it is calling its own subroutines. In reality these stubs are transferring the data and the function down to a module called the RPC Runtime. This module is responsible for finding the server that can satisfy the RPC command. Once found, the function and data are sent to the server, where they are picked up by the RPC Runtime module on the server. The server piece then loads the needed library for the function, builds the appropriate data structure, and calls the function. The function thinks it is being called by the client application. When the function is completed, any return values are collected, formatted, and sent back to the client via the RPC Runtime modules. When the function returns to the client application, it either has the appropriate returned data or it has an indication that the function failed in stream.

Finally at the top of the mountain! From the application viewpoint there are two sets of commands that can cause network traffic: any I/O command, such as Open, which contains a UNC name, and WNet commands. UNC commands are sent to the MUP in the Windows NT kernel, where it finds a UNC provider or redirector that can make a connection to the specified UNC name. WNet commands are passed to the MPR, which passes the request to each redirector in turn until one is found that can satisfy the request. One machine gains access to another machine via a redirector. Windows NT ships with a redirector that allows connection to LAN Manager, LAN Server, and MS-Net servers. This redirector communicates to the protocol stacks to which it is bound via the TDI layer. The TDI layer is a boundary layer between the file system modules and the network protocol stacks. Boundary layers are used to provide a unified platform for

others to develop “plug-and-play” components. Windows NT ships with three protocol stacks: TCP/IP, NetBEUI, and DLC. TCP/IP is wrapped in the Streams driver. Streams will make porting other protocol stacks to Windows NT easier. Protocol stacks communicate with the network interface card (NIC) via an NDIS device driver. NDIS 3.0 provides another boundary layer that makes interoperability between components at different layers easier. In addition to providing file and print sharing capabilities, Windows NT provides five mechanisms for building distributed applications. Named pipes, mailslots, NetBIOS, Sockets, and RPC can all be used. The most portable is the RPC mechanism. RPC uses other IPC mechanisms to transfer functions and data between client and server machines.

Through this process we have seen how the three main goals of the design for networking within Windows NT have been accomplished. First, file and print services are provided through the default server and workstation components. These default server and workstation modules are the progression of the LAN Manager technology into the Windows NT environment and provide backward compatibility for your existing LAN Manager-based networks. Second, we have seen support for client/server applications in the rich availability of IPC mechanisms such as named pipes, Windows sockets, and of course RPCs. And finally, we have seen the design of an expandable architecture based on standard boundary layers which others can (and are) building upon.

If there are any comments on this article, or suggestions for future articles, please contact me:

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Conversion of NTFS Long Filenames to FAT Filenames

By Caribe Malo, Corporate Technology Team

The file allocation table (FAT) filename is an attribute that is created automatically when a file is created, and is resident within the associated file record. The following rules are used to compute the FAT filename. First, all illegal characters in the NT File System (NTFS) name are converted to underscores (_). Then all spaces are removed from the name, as well as all periods *up to* the last period. The name is then truncated to six characters before the period, and three characters after the *last* period in the long filename, if there is one. A tilde (~) and a sequence number are then added. Single-digit

numbers are used, first starting with 1, then double, and so on, until a unique name is produced. What this means is that a naming strategy is to make the first eight characters of the filename express the filename as uniquely as possible. The last period is important. If you are using files with long names on a shared NTFS volume from a Windows workstation that uses file association to start the appropriate application, you will want to make sure that the extension you expect follows the last period.

TestOneOnOne.TXTG000.00	□	TESTON~1.00
Long filename		Short filename

If you are not sure what short filename will be produced from the long name, you have the ability to disclose the full file details either from the File Manager or by typing in **dir /x** from the command prompt. Both of these methods will tell you what short filename will be produced. The Win32 API can also be queried for this information.

Microsoft SQL Server Administration: Managing the Split In Responsibilities between System Administrator and Database Administrator

By Shawn Aebi, Systems Engineer, Microsoft

This article explains the differences in capabilities between the System Administrator and the Database Administrator in Microsoft SQL Server. It discusses the existing permissions heirarchy and identifies areas where the permissions differ between the administrators.

General Description

There are three types of special users who can administer and control SQL Server: System Administrators, Database Owners, and Database Object Owners.

The System Administrator (SA)

When SQL Server is installed, the SA is the owner of the master database.

The SA has the following privileges by default:

- Installing SQL Server
- Creating devices and databases
- Managing and monitoring the use of disk space, memory, and connections
- Transferring data in and out of SQL Server databases
- Backing up and restoring databases
- Diagnosing system problems
- Tuning SQL Server to achieve best performance

The SA account operates outside the protection system—no permission checking is done for SA operations. The SA can and should be considered the super-user, given permission to use, alter, and delete devices, databases, and objects throughout the system. This unique permission set is required to allow for repair of structures.

The Database Owner (DBO)

The SA grants the DBO authority to create the database with the GRANT statement. The DBO has full privileges within the database.

The DBO can:

- Create and alter their database (if given permission by the SA)

- Add users to their database
- Use the GRANT statement to extend permissions within the database
- Set up groups of users

The DBO cannot perform any of these operations on other databases unless explicitly given similar authority by the SA.

The Database Object Owner (DBOO)

Database objects are tables, indexes, views, defaults, triggers, rules, and procedures. The user who creates a database object is the DBOO. The DBO must grant permission to the user to create these objects.

Login and User Accounts

Users of SQL Server databases need both a login ID (to access the server) and a user ID (to access each database). The procedure to add users to SQL Server databases and to grant permissions can be performed entirely by the SA or split between the SA and the DBO according to the following rules:

- Only the SA can add a login ID.
- Either the SA or the DBO can add a user ID.
- Multiple people can be assigned DBO privileges through the use of aliasing.
- Only the SA or DBO can grant statement permissions to other users.

Command	Description	Authority
sp_addlogin	adds a login ID to the SQL Server Registry, add password and default db	SA only
sp_adduser	adds a user ID to the database	SA/DBO
sp_addalias	ties a login ID to an alias	SA/DBO
sp_addgroup	adds a group to a database	SA/DBO
sp_dropuser	drop a user ID from the database	SA/DBO
sp_droplogin	drop a login ID from the database	SA only

sp_dropalias	drop a user ID from an alias	SA/DBO
sp_dropgroup	drop a group from the database	SA/DBO
sp_changedbowner	change the DBO	SA only
sp_defaultdb	change a login ID default database	SA/DBO/Users
sp_password	change a users password	SA/DBO/Users

The following table groups Transact-SQL commands by responsibility:

Responsibility/commands	Ability to extend/limit permissions
System Administrator:	
CREATE DATABASE	YES
DISK INIT	NO
DISK MIRROR	NO
DISK REFIT	NO
DISK REINIT	NO
DISK REMIRROR	NO
DISK UNMIRROR	NO
KILL	NO
RECONFIGURE	NO
SHUTDOWN	NO
Database Owner:	
ALTER DATABASE	NO

CHECKPOINT	NO
CREATE DEFAULT	YES
CREATE PROCEDURE	YES
CREATE RULE	YES
CREATE TABLE	YES
CREATE VIEW	YES
DBCC	NO
DUMP DATABASE	YES
DUMP TRANSACTION	YES
GRANT	NO
LOAD DATABASE	NO
LOAD TRANSACTION	NO
REVOKE	NO
SETUSER	NO

Database Object Owner:

ALTER TABLE	NO
CREATE INDEX	NO
CREATE TRIGGER	NO
DELETE	NO
INSERT	YES
READTEXT	YES
SELECT	YES
TRUNCATE TABLE	NO
UPDATE	YES
UPDATE STATISTICS	NO
WRITETEXT	YES

Note that each of these groups has the capability to drop objects which they are allowed to create. That is, SAs can drop devices, DBOs can drop databases, and DBOOs can drop tables and indexes. These permissions cannot be extended or withdrawn.

Public commands

sp_configure	All can run, only SA can change
sp_dboption	All can run, only SA/DBO can change
sp_monitor	All can run
sp_helpdb	All can run
sp_logdevice	All can run, only SA/DBO can change
sp_addsegment	All can run, only SA/DBO can change
sp_who	All can run
SET commands	All can run
BEGIN/COMMIT/ ROLLBACK TRANsaction	All can run
bcp	With INSERT permission, all can run
isql	With access to program, all can run

System Tables

There are 13 system tables which are monitored by the SA, and 13 system tables created for each database, which can be monitored by the DBO.

Master-Only System Tables

SYSDBASES	SYSLOGINS	SYSPROCESSES	SYSCONFIGURES
SYSCURCONFIGS	SYSDEVICES	SYSCHARSETS	SYSUSAGES

SYSLOCKS SYSMESSAGES SYSLANGUAGES SYSSERVERS

SYSREMOTEOLOGI
NS

Database System Tables

SYSOBJECTS SYSUSERS SYSLOGS SYSSEGMENTS

SYSALTERNATES SYSCOLUMNS SYSCOMMENTS SYSDEPENDS

SYSINDEXES SYSPROCEDURES SYSTYPES SYSKEYS

SYSPROTECTS

In summary, for the projects we are currently investigating, SQL Server offers a powerful step in authority between System Administrators and Database Administrators.

- System Administrators must install SQL Server and perform initial structuring (create the OS/2 volumes, database devices).
- System Administrators must create the login IDs for anyone logging on to that SQL Server.
- All Database Administrators must have user IDs in the master database.
- Database Administrators can build their own databases, assign their own users, and set their own permissions.
- Database Administrators can dump and load their databases and associated logs.
- Most tuning can be done by the Database Administrator. Memory, fillfactor, and procedure cache size are controlled with the sp_configure command which only the SA can run.
- Only System Administrators can kill processes or shut down the server.
- After each database creation or drop, it is recommended that the master database be dumped. This can only be done by the System Administrator.

Assigning Primary and Secondary Responsibilities

What follows is a matrix which each project team should build for themselves. There should be an understanding, either oral or written, of who will take actions for certain tasks. This will save countless finger pointing and speed up troubleshooting time. In many cases, the SA and DBA could be the same person. However, in tightly secure environments or on large projects, this boundary needs to be carefully constructed and audited.

Responsibility Matrix

Task	SA	DBA
Server setup, configuration, maintenance of server parameters	P	S
Create/Drop Devices	P	S
Create/Drop Segments	S	P
Create/Drop Logins	X	
Create/Drop/Alter Databases; add users	S	P
Create/Drop Database Objects (tables, indexes, views, procs)		X
Grant/Revoke DB Objects/Statement Permissions		X
Database Load/Refresh		X
Database Backup		
Master DB	X	

Other DB	P	S
Database Recovery		
Master DB	X	
Other DB	S	P
Database Tuning		
Server Tuning	P	S
Server/DB Monitoring		
	P	S

P = Primary, S = Secondary, X = Exclusive

I hope that you have found this summation of the varying SQL Server administrative roles informative. Most of this information comes from the *Microsoft SQL Server System Administrators Guide*. I have found this to be an excellent source of information from which to learn more about the administrative roles and responsibilities for SQL Server.

Understanding Windows NT POSIX Compatibility

By Ray Cort, Corporate Technology Team

This article will discuss the following topics:

- What is POSIX?
- Implementation in Windows NT
- Application conformance
- Verification and conformance
- Windows NT POSIX files
- Running POSIX applications
- Restrictions on POSIX applications

What is POSIX?

POSIX stands for *Portable Operating System Interface* for computing environments. POSIX began as an effort by the IEEE community to promote the portability of applications across UNIX environments by developing a clear, consistent, and unambiguous set of standards. However, POSIX is not limited to the UNIX environment. It can also be implemented on non-UNIX operating systems, as was done with the IEEE Std 1003.1-1990 (POSIX.1) implementation on Virtual Memory System (VMS), Multiprogramming Executive (MPE), and the Conversion Technology Operating System (CTOS). POSIX actually consists of a set of standards that range from POSIX.1 to POSIX.12.

As the following table shows, most of these standards are still in the proposed state. This article deals with the Windows NT implementation of a POSIX subsystem to support the international ISO/IEC IS 9945-1:1990 standard (also called POSIX.1). POSIX.1 defines a C language source code-level application programming interface (API) to an operating system environment.

Family of POSIX Standards

Standard	ISO Standard?	Description
POSIX.0	No	A Guide to POSIX Open Systems Environment. This is not a standard in the same sense as POSIX.1 or POSIX.2. It is more of an introduction and overview of the other standards.
POSIX.1	Yes	Systems API (C Language)
POSIX.2	No	Shell and tools (IEEE-approved standard)
POSIX.3	No	Testing and verification
POSIX.4	No	Real-time and threads
POSIX.5	Yes	ADA language bindings to POSIX.1
POSIX.6	No	System security
POSIX.7	No	System administration
POSIX.8	No	Networking Transparent file access Protocol-independent network interface Remote Procedure Calls (RPC) Open system interconnect protocol-dependent application interfaces
POSIX.9	Yes	FORTRAN language bindings to POSIX.1
POSIX.10	No	Super-computing Application Environment Profile (AEP)
POSIX.11	No	Transaction Processing AEP
POSIX.12	No	Graphical user interface

POSIX Implementation in Windows NT

The POSIX subsystem is implemented in Windows NT as a protected server. POSIX applications communicate with the POSIX subsystem through a message-passing facility in the Executive known as a Local Procedure Call (LPC).

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Figure 1: POSIX Subsystem in Windows NT

The POSIX subsystem, as well as each POSIX application, runs in its own protected address space which protects it from any other application that might be running on Windows NT. POSIX applications are preemptively multitasked with respect to each other and to other applications running in the system.

POSIX Conformance

For a system to be given a certificate of POSIX.1 conformance, it must meet the following requirements:

- The system must support all of the interfaces as defined in the ISO/IEC 9945-1.
- The vendor must supply a POSIX.1 Conformance Document (PCD) with their implementation as specified in ISP/IEC 9945-1.
- The implementation must pass the appropriate National Institute of Standards and Technology (NIST) test suite.

Application Compliance to POSIX.1

Many people talk about a “POSIX-compliant” application, but what does that really mean? For POSIX.1, there are four categories of compliance, ranging from a very strict compliance to a very loose compliance. The various categories are outlined in the following subsections:

Strictly-Conforming POSIX.1 Applications

A strictly-conforming POSIX.1 application requires only the facilities described in the POSIX.1 standard and applicable language standards. This type of application accepts the following:

- Any behavior described in ISO/IEC 9945-1 as unspecified or implementation-defined
- Symbolic constants
- Any value in the range permitted by ISO/IEC 9945-1

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Figure 2

This is the strictest level of application conformance. Applications at this level should be able to move across implementations with just a recompilation. At the time of this writing, the only language interface that has been standardized for POSIX.1 is the C language interface. (As shown in Figure 2, a strictly-conforming POSIX application can use 110 calls from the standard C libraries.)

Applications Conforming to ISO/IEC and POSIX.1

An ISO/IEC-conforming POSIX.1 application is one that uses only the facilities described in ISO/IEC 9945-1 and approved conforming language bindings for ISO or IEC standards. This type of application must include a statement of conformance that documents all options and limit dependencies, and all other ISO or IEC standards used.

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Figure 3

This level of conformance is not as strict as the previous one for two reasons. First, it allows a POSIX.1 application to make use of other ISO or IEC standards, such as Graphical Kernel System (GKS). Second, it allows POSIX.1 applications within this level to require options or limit values beyond the minimum. For example, such an application could require that the implementation support filenames of at least 16 characters. The POSIX.1 minimum is 14 characters.

Applications Conforming to POSIX.1 and <National Body>

A <National Body>-conforming POSIX.1 application differs from an ISO/IEC-conforming POSIX.1 application because this type of application may also use specific standards of a single ISO/IEC organization, such as American National Standards Institute (ANSI) or British Standards Institute (BSI). This type of application must include a statement of conformance that documents all options and limit dependencies, and all other <National Body> standards used.

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Figure 4

For example, you could have a <National Body>-conforming POSIX application that used calls from a BSI-standard set of calls.

POSIX.1-Conformant Applications That Use Extensions

A conforming POSIX.1 application using extensions is an application that differs from a conforming POSIX.1 application only because it uses non-standard facilities that are consistent with ISO/IEC 9945-1. Such an application must fully document its requirements for these extended facilities.

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Figure 5

This is the lowest level of conformance; almost any C program could satisfy this with the appropriate documentation.

This current release of Windows NT supports Strictly-Conforming POSIX.1 Applications, and ISO/IEC-Conforming POSIX.1 Applications. Windows NT supports the latter because only 110 of the 149 functions of standard C are part of POSIX.1, and standard C is itself an ISO standard (ISO/IEC 9899).

Conformance Testing

Windows NT is in the process of being verified for POSIX.1 conformance, and will be submitted to NIST for the Federal Information Processing Standards Publication (FIPS) 151-2 certification. FIPS 151-2 incorporates POSIX.1 as a reference standard and also requires a number of the optional features defined in POSIX.1 to promote application portability among conforming implementations. An implementation that conforms to FIPS 151-2 also conforms to POSIX.1. Note that conformance is specific to the manufacturer, hardware platform, and model number on which the implementation is tested.

Running POSIX Applications

POSIX applications can be started from a Windows NT console window (command prompt); File Manager; Program Manager; or by invocation from within another POSIX application.

The POSIX Files

The following files are required to support the POSIX subsystem and run POSIX applications:

- PSXSS.EXE, the POSIX subsystem server
- PSXDLL.DLL, the POSIX dynamic-link library
- POSIX.EXE, the POSIX console session manager

File Systems

POSIX requires a certain amount of functionality from the file system, such as the ability for a file to have more than one name (or *hard links*), and case-sensitive file naming. Neither FAT nor HPFS supports these features, which is another reason why a new file system was required for Windows NT. NTFS supports both hard links and case-sensitive naming. If you want to run in a POSIX-conforming environment, you need at least one NTFS disk partition on your computer.

You can run POSIX applications from any Windows NT file system. If the application does not need to access the file system, the application will run with no problems. However, if the application does require access to the file system, there is no way to guarantee that it will behave correctly on a non-NTFS disk partition.

Bypass Traverse Checking

By default, when you install Windows NT for the first time, the user right "Bypass traverse checking" is granted to everyone. This right allows a user to change directories through a directory tree even if the user has no permission for those directories.

If you want to run in a POSIX-conforming environment, you must disable this privilege for your account by using either the User Manager or User Manager for Domains tool as follows (you must be an administrator to do this):

1. Select the account.
2. Choose User Rights from the Policies menu to display the following dialog box. Be sure the Show Advanced User Rights check box is marked.
3. Specify the Bypass traverse checking right.
4. Choose Remove.

Figure 6

Printing

The POSIX subsystem itself does not directly support printing, but Windows NT supports redirection and piping between subsystems. If your POSIX application writes to stdout, and you have connected or redirected either your serial or parallel ports to a printer, you can redirect the output of a POSIX application to that printer. For example, the following sequence of commands will send the output of a POSIX application that writes to stdout, to a network printer.

```
NET USE LPT1: \\MYSERVER\PRINTER
POSIXAPP.EXE > LPT1:
```

Network Access

The POSIX.1 specification does not have a requirement for access to remote file systems, but as with any of the other subsystems, the POSIX subsystem and POSIX applications have transparent access to any Win32 remotely-connected file system.

Communicating with Other Subsystems

Windows NT supports a common command processor that can execute commands from any of the subsystem. Furthermore, Windows NT supports the piping of input and output between commands of different subsystems. So, it is possible to do the following:

Windows NT supports a common command processor that can run commands from any of the subsystems. In addition, Windows NT supports piped input and output between commands of different subsystems. For example, you could type the following command to list the contents of the current directory, then pipe the results through the **more** command to the console:

```
ls -l | more
```

The **ls** utility is implemented in the POSIX subsystem and generates output as shown in

Figure 7.

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Figure 7

Figure 8 illustrates how a POSIX application interacts with other components of the Windows NT operating system.

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Figure 8

A certain amount of functionality can be gained by using a single command shell of Windows NT. From a programming point of view, while not elegant, it is possible to put a Win32 graphical front-end on a POSIX application by using the redirection of stdin and stdout.

Restrictions on POSIX Applications

With this release of Windows NT, POSIX applications have no direct access to any of the facilities and features of the Win32 subsystem, such as memory-mapped files, networking, graphics, or dynamic data exchange.

Further Information

For further information on the POSIX standards, contact either or both of the following resources.

For information on POSIX.1 (ANSI/IEEE 1003.1-1990, ISO/IEC 9945-1:1990):

Publication Sales
IEEE Service Center
P.O. Box 1331
445 Hoes Lane
Piscataway, NJ 08855-1331

For information on other POSIX standards:

IEEE Computer Society
Attention Assistant Director/Standards
1730 Massachusetts Avenue Northwest
Washington, DC 20036

Microsoft® Windows NT™ Beta March 1993 Hardware Compatibility List Update

The following computers and peripherals have passed Windows NT compatibility testing as of May 1993. This list is a subset of the hardware we expect to support in the final product and was current at the time it was published. If your hardware is not listed here, contact your hardware manufacturer for more information. We have not tested every computer and/or device in all possible configurations.

Updates to this list will appear in Library 1 of the WINNT forum (GO WINNT) or Library 17 of the MSWin32 forum (GO MSWIN32) on CompuServe Information Services.

x86 Architecture Uniprocessor Computers

Any computer 100% compatible with those in the following list:

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Absolute Computer 486/66 VL/EISA
ACD OPTIMA 486 DX 33 VL
ACD OPTIMA 486 DX 50 VL
ACD OPTIMA 486 DX2 66 VL
ACER 1120sx
ACER 1170
ACER AcerFrame 1000 (Model 1733)
ACER AcerFrame 300
ACER AcerFrame 500 (Model F433TE)
ACER AcerPower 425s
ACER AcerPower 433e
ACER AcerPower 486/33
Actech Action 486 50
ADD-X Systemes 486/33Mhz EISA bus
ADD-X Systemes 486/33Mhz ISA bus
ADI 486SLC-25 NoteBook
ADPS 486 Power Notebook 486DX2-50Mhz
ADPS 486 Power Notebook Color 486-33Mhz
ADPS Ambassador
ADPS Bat Computer-33MHz
ADPS Bat Computer-50MHz
ADPS Local Bus 33
ADPS Medallion
ADPS Multimedia Power House
ADPS Power Notebook 486-33Mhz
ADPS System 3000
ADPS System 4000
ADPS System 5000
ADPS System 6000 EISA
ADPS System 6000 Plus
ADPS System 6000 Plus EISA
ADS Upgradeable 3/486
Alfa Deltacom 386-33
Alfa Deltacom 486-33
Alfa Deltacom 486-50
Alfa Deltacom 486SX-25
Alfa Deltacom EISA 486-50
Alfa VESA 486DX2-66
Alps® CP-EX1 386/25
ALR BusinessVEISA 3/33
ALR BusinessVEISA 4/50D
ALR BusinessVEISA 4/66D
ALR Flyer 3/25S
ALR Flyer 32DT 4/25S
ALR Flyer 32DT 4/50D
ALR Flyer 32DT 4/66D
ALR Flyer 32LCT 4/25S
ALR Flyer 32LCT 4/50D
ALR Flyer 32LCT 4/66D
ALR Modular Processor System 486/25
ALR Modular Processor System 486/33
ALR Modular Processor System 486/50
ALR Modular Processor System 486DX2/66
ALR PowerCache 4 33e
ALR POWERPRO SMP4/33
ALR POWERPRO VM/64
ALR POWERPRO VM4/66d
ALR POWERPRO/MC SMP4/50D
ALR POWERPRO/MC SMP4/66D
ALR POWERPRO/MC VM4/66D
ALR PROVEISA SMP4/66D
ALR RANGER M4/25S
ALR RANGER MC4/25
ALR RANGER MC4/25S
Altos System 4500 (Model 4533)
Altos System 4500 (Model 4550)
Altos System 4500 (Model 4566)
Annabelle Bits ASI 386SX 25MHz
Annabelle Bits ASI 486DX 33MHz
Annabelle Bits ASI 486DX 50MHz
Annabelle Bits ASI 486SX 25MHz
Apricot® FTS 486DX2-50
Apricot LAN Station 386SX/20
Apricot LS-Pro 486SLC/33
Apricot XEN-LS 486SX/20
ARCHE 402H
Ariel 486DX2-66ES
Ariel 486DX2-66VLS
Asem 486DX2/66
ASL 333
ASL 433
AST® Bravo 3/25s Model 3V
AST Bravo 486/50
AST Bravo LC 4/33
AST Bravo LC 4/50d
AST Bravo LC 4/66d
AST Power Premium 4/33 Model 213V
AST Power Premium 486/33 EISA
AST Power Premium 486/50d
AST Premium 386/33T
AST Premium II 386/33 Model 213V
AST Premium II 486/33
AST Premium SE 4/33 Model 333
AST Premium SE 4/50
AST Premium SE 4/66d
AST Premium SE 486/33
AST Premmia 4/33
AST Premmia 4/33SX
AST Premmia 4/66d
AST Tower SE 486/50
AST Tower SE 486/50d
AST Tower SE 486/66
Athena LINEA HQ 3000DX40C SMART
Athena LINEA HQ 4000DX2 50C FAST
Athena LINEA HQ 4000DX2 66C FAST
Athena LINEA HQ 4000DX33C
Athena LINEA HQ 4000DX50C FAST
Athena LINEA HQ 4000SX25
Austin 486DLC
Austin 486DX2-66MHz WINSTATION W/VESA

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LOCAL BUS
BBSK GTEK 486/33 LB
BBSK GTEK 486/66OD LB
Brett 486DX/33/256K
Brett 486DX/50/256K
Brett 486DX2/66/256K
Brett 80486SX/25/256K
Bull ALL-IN-ONE 486DX2/66
Bull Work Centre 486
CAF CT-02 L737/486DX-33
Caliber FRL EISA 486DX2-66
Caliber FRL EISA 486DX33
Caliber FRL EISA 486DX50
Caliber FRL ISA 486DX-33 UNICHIP
Caliber FRL ISA 486DX-50 UNICHIP
Caliber FRL ISA 486DX2-66 UNICHIP
Caliber FRL ISA 486SX-33 UNICHIP
Caliber FRL VESA 486dx-33
Caliber FRL VESA 486dx-50
Caliber FRL VESA 486DX2/66M
Caliber FRL VESA 486SX-33
Chicony Electronics 486SLC/33MHz
Chicony Electronics Chicony 486 33P
Club AMERICAN 486-50Mhz
Club FALCON SERIES 386/33
Club FALCON SERIES 486DX/33
Club FALCON SERIES 486DX2/50
Club FALCON SERIES 486DX2/66
CMS Enhancements AnyBus 486dx-50
Commadore 486DX-33C
Commadore 486DX-33C Local Bus
Commadore T486DX-50C
Compaq® Contura 4/25C
Compaq Deskpro 386/20e®
Compaq Deskpro 386/25®
Compaq Deskpro® 386/25e
Compaq Deskpro 386/33®
Compaq Deskpro 386/33L
Compaq Deskpro 386s®/20
Compaq Deskpro 4/66i
Compaq Deskpro 486/25
Compaq Deskpro 486/25i
Compaq Deskpro 486/33i
Compaq Deskpro 486/33L
Compaq Deskpro 486/33M
Compaq Deskpro 486/50L
Compaq Deskpro 66M
Compaq LTE 386s/20
Compaq LTE Lite 4/25C
Compaq Portable 486c
Compaq Portable 486C/66
Compaq ProLinea 4/33
Compaq ProLinea 4/50
Compaq ProSignia 486DX/33
Compaq ProSignia 486DX2/66
Compaq Systempro®/LT 386/25
Compaq Systempro/LT 486/33
Compaq Systempro/LT 486DX2/50
Compaq Systempro/LT 486DX2/66
Compaq Systempro/LT 486SX/25
CompuAdd® 320
CompuAdd 420s
CompuAdd 433
CompuAdd 433 ELB
CompuAdd 433 LB
CompuAdd 433 LP
CompuAdd 433DLC LP
CompuAdd 433E
CompuAdd 450
CompuAdd 450DX2 LP
CompuAdd 466/DX2
CompuAdd 466DX2 LB
CompuAdd 466DX2E LB
CompuAdd 486-33DLC
Computer Extension CESI 486 66
Computer Sales Prof. 386DX/40
Computer Sales Prof. 486DX/33
Computer Sales Prof. 486DX/33VL
Computer Sales Prof. 486DX/50
Computer Sales Prof. 486DX2/50
Computer Sales Prof. 486DX2/66
Computer Sales Prof. 486SX/25MPC
CSS Labs 486-33 MGE
CSS Labs MaxSys 433MTA
CSS Labs MaxSys 433MTMGE
CSS Labs MaxSys 433TA
CSS Labs MaxSys 433TMGE
CSS Labs MaxSys 450MTMGE
CSS Labs MaxSys 450TMGE
CSS Labs MaxSys 452MTMGE
CSS Labs MaxSys 452TMGE
CSS Labs MaxSys 462MTA
CSS Labs MaxSys 462MTE
CSS Labs MaxSys 462MTMGE
CSS Labs MaxSys 462TA
CSS Labs MaxSys 462TE
CSS Labs MaxSys 462TMGE
CSS Labs Preferred 433GA
CSS Labs Preferred 433GE
CSS Labs Preferred 433MGE
CSS Labs Preferred 450MGE
CSS Labs Preferred 452MGE
CSS Labs Preferred 462GA
CSS Labs Preferred 462GE
CSS Labs Preferred 462MGE
Cube 340 ATX
Cube 433 ATX
Cube 450 ATX
Daewoo Modular Desktop/2300
Daewoo Modular Mini Tower/2400

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Danjen 486DLC 33 MHz
Danjen 486DX 33 MHz Local Bus
Danjen 486DX 50 MHz EISA
Danjen 486DX 50 MHz ISA
Dassault DASSAULT AT CUSTOMER
ACTIVATED TERMINAL D633
Data Stor 386-33 Desktop
Data Stor 386-33 Tower
Data Stor 486-33 Desktop
Data Stor 486-33 Tower
Data Stor 486-50 Desktop
Data Stor 486-50 Tower
Data Stor 486-50E Tower
Data Stor 486-66 Desktop
Data Stor 486-66 Tower
Data Stor 486-66E Desktop
Data Stor 486-66E Tower
Datapoint 7436 Workstation/Server
Datapoint Slimline Desktop 486/25
Datapoint Workstation/Server 486/33
Datavarehuset BRICK 486DX-33 Local Bus
Datavarehuset BRICK 486DX-50 EISA
Datavarehuset BRICK 486DX2-50
Datavarehuset BRICK 486DX2-66 Local Bus
DCI 486SX-25
Debis DCS EISA Tower modular
Debis DCS MT 486 EISA
Deico 486DLC
Dell@ PowerLine System 433DE
Dell PowerLine System 433E
Dell PowerLine System 433SE
Dell PowerLine System 450DE/2 DGX
Dell PowerLine System 450SE
Dell PowerLine System 486D/33
Dell PowerLine System 486D/50
Dell PowerLine System 486P/33
Delphi Olympus
Delta Micro System GL 4D33V
Delta Micro Systems Gold Line 4D50C
Delta Micro Systems Gold Line 4D50C/2
Delta Micro Systems Gold Line 4E50C
DFI 486DX-33 Desktop System
DFI 486DX-33 Mini-Tower System
DFI 486DX-33 Tower System
DFI 486DX-50 Desktop System
DFI 486DX-50 Mini-Tower System
DFI 486DX2-50 Desktop System
DFI 486DX2-50 Mini-Tower System
DFI 486DX2-66 Desktop System
DFI 486DX2-66 Mini-Tower System
DFI 486SX-25 Desktop System
DFI 486SX-25 Mini-Tower System
Digital Equipment applicationDEC 400xP
Digital Equipment DECpc 425 ST
Digital Equipment DECpc 433 ST
Digital Equipment DECpc 433 Workstation
Digital Equipment DECpc 433dx LP
Digital Equipment DECpc 433dx MT
Digital Equipment DECpc 433dx MTE
Digital Equipment DECpc 433T
Digital Equipment DECpc 450 ST
Digital Equipment DECpc 450d2 LP
Digital Equipment DECpc 450d2 MT
Digital Equipment DECpc 452 ST
Digital Equipment DECpc 466 ST
Digital Equipment DECpc 466d2 LP
Digital Equipment DECpc 466d2 MT
Digital Equipment DECpc 466d2 MTE
Digital Equipment DECstation® 425c
Dolch C.P.A.C. 386-33C
Dolch C.P.A.C. 486-33C
Dolch C.P.A.C. 486-50 EISA
Dolch C.P.A.C. 486-66C
Dolch V.P.A.C. 386-33C
Dolch V.P.A.C. 486-33C
Dolch V.P.A.C. 486-66C
DTK FEAT5031
DTK Grafika 4F
DTK Grafika 4G
DTK SPAN5030
Dunn 486-33I
Dynamic Decisions Dynex Professional 486 33
Dynamic Decisions Dynex Professional 486 50
Edge 486DX2-66 ISA
Elonex PC-400 Series Computer
Epson® 48633\DX Express Station
Epson 486SX\25 Express Station
Epson EISA Series 486DX\33
Epson EISA Series 486DX\50
Epson EISA Series 486SX\25
Epson Equity 386DX\33 Plus
Epson Equity 386SX\25 Plus
Epson Equity 4DX\33
Epson Equity 4SX\25
Epson Progression 486DX\33
Epson Progression 486DX2\66
Epson Progression 486SX\25
Epson Progression 4DX2\50
Ergo NoteBrick 486/50
Ergo Ultra Moby Brick 486/66
Evercom 486/50
Everex™ Cube DX/2 66
Everex Modular 486/20 SX
Everex Step 486/25 Desktop
Everex Step 486/33 12 Slot EISA
Everex Step 486/33 8 Slot EISA
Everex Step 486/33 ISA
Everex Step 486DX2/50 EISA 12
Everex Tempo 486DX2/50
Everex Tempo 486DX2/50 Desktop

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Everex Tempo 486SX/20
Everex Tempo 486SX/25
Evergreen Systems CAPcard 325E
Fast 486DX/33
First LEO 4386VCV DX33
First LEO 486VC DX2/66
First LEO 486VC DX50
First Venus 486/33 VESA
First Venus 486/50
First Venus 486DX2/50
First Venus 486DX2/66
First Venus 486DX2/66 VIO
First VIA 486DX-50 Cache system
FMC High Performance 486 EISA
Fountain Technology 386DX/40
Fountain Technology 486DX/33
Fountain Technology 486DX/33 VL
Fountain Technology 486DX/50
Fountain Technology 486DX2/50
Fountain Technology 486DX2/66
Fountain Technology 486SX/25MPC
G2 486SX/25
G2 80486/33
G2 80486/50
G2 80486DX/50E
G2 80486DX2/66
G2 80486sx/25
Gateway 2000 386SX/20C
Gateway 2000 486/33C
Gateway 2000 486/33E
Gateway 2000 486DX2/50
Gateway 2000 486DX2/50E
Gateway 2000 486DX2/66V
Gateway 2000 486SX/33
GCH AEGIS 433
GCH AEGIS 466
GCH EasyData 433HI
GCH EasyData 466HI
GCH EasyDate 466HI VL
GCH EiSYS Ei433DX
GCH EiSYS Ei466DX2
GES DATAMINI MF 486DX-33
GES DATAMINI MF 486DX2-66
GES DATAMINI MF 486SX-25
GES DATEMINI MF 486SX-20
GoldStar 425SX
GoldStar 433SLC
GoldStar 725C Notebook
GoldStar 725S
GoldStar GS333S
GRiD® 486ei-33
GRiD 486EI25 SVR
GRiD APT/425se
GRiD APT/450e
GRiD MFP 425s+

GRiD MFP 433+
GRiD MFP 433s+
GRiD MFP 450+
GRiD MFP 466+
GRiD MFP/420s
GRiD MFP/425s
GRiD MFP/450
GRiD MFP/540
Hancke & Peter 386w Professional
Hancke & Peter 486/33w Professional
Hancke & Peter 486/50w Professional
Hancke & Peter 486/66w Professional
Hancke & Peter 486w EISA Professional
Hanterex VEGAS 3640
Harris Epoch 486-50 ISA
Harris Epoch 486/33 ISA
Harris Epoch 486/50 EISA
Hauppauge 4860 EISA DX2-66
Hauppauge 486M Local Bus DX2-66
Hertz 486/D33Ee
Hertz 486/D50e
Hertz 486/D50Ee
Hertz 486/D66X2e
Hertz 486/S25e
Hetra 205T 486/33
Hewitt Rand HR 486-50C
HM Systems Minstrel Xpresso 386
HM Systems Minstrel Xpresso 486
HP® NetServer 486/33 LE
HP NetServer 486/33 LM
HP NetServer 486d/66 LE
HP NetServer 486d/66 LM
HP NetServer 486s/33 LE
HP Vectra® 386/25
HP Vectra 486/25T
HP Vectra 486/25U
HP Vectra 486/33N
HP Vectra 486/33ST
HP Vectra 486/33T
HP Vectra 486/33U
HP Vectra 486/50U
HP Vectra 486/66ST
HP Vectra 486/66U
HP Vectra 486S/20
HP Vectra RS/25C
Hyundai CS-486SX/25
IBM® PS/1® 2133-xxx 486SX/25
IBM PS/1 2133-xxx 486SX/33
IBM PS/1 2155-xxx 486DX/33
IBM PS/1 2155-xxx 486DX2/50
IBM PS/1 2155-xxx 486DX2/66
IBM PS/1 2155-xxx 486SX/25
IBM PS/1 2155-xxx 486SX/33
IBM PS/1 2168-xxx 486DX/33
IBM PS/1 2168-xxx 486DX2/50

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IBM PS/1 2168-xxx 486DX2/66
IBM PS/1 2168-xxx 486SX/25
IBM PS/1 2168-xxx 486SX/33
IBM PS/2® Model 56 8556-xxx 486SLC/20
IBM PS/2 Model 56 9556-xxx 486SLC2/50
IBM PS/2 Model 57 8557-xxx 486SLC/20
IBM PS/2 Model 57 9557-xxx 486SLC2/50
IBM PS/2 Model 70 8570-xxx 386DX/20
IBM PS/2 Model 70 8570-xxx 386DX/25
IBM PS/2 Model 70 8570-xxx 486DX/25
IBM PS/2 Model 76 9576-xxx 486DX2/66
IBM PS/2 Model 76 9576-xxx 486SX/33
IBM PS/2 Model 77 9577-xxx 486DX2/66
IBM PS/2 Model 77 9577-xxx 486SX/33
IBM PS/2 Model 80 8580-xxx 386DX/16
IBM PS/2 Model 80 8580-xxx 386DX/25
IBM PS/2 Model 90 XP 486 8590-0H* 486SX/25
IBM PS/2 Model 90 XP 486 8590-0J* 486DX/25
IBM PS/2 Model 90 XP 486 8590-0K* 486DX/33
IBM PS/2 Model 90 XP 486 8590-0L* 486DX2/50
IBM PS/2 Model 90 XP 486 8590-xxx with
486DX2/66 Processor Upgrade
IBM PS/2 Model 90 XP 486 9590-0L* 486DX2/50
IBM PS/2 Model 90 XP 486 9590-xxx with
486DX2/66 Processor Upgrade
IBM PS/2 Model 95 XP 486 8595-0H* 486SX/25
IBM PS/2 Model 95 XP 486 8595-0J* 486DX/25
IBM PS/2 Model 95 XP 486 8595-0K* 486DX/33
IBM PS/2 Model 95 XP 486 8595-0L* 486DX2/50
IBM PS/2 Model 95 XP 486 8595-0M* 486DX/50
IBM PS/2 Model 95 XP 486 8595-xxx with
486DX2/66 Processor Upgrade
IBM PS/2 Model 95 XP 486 9595-0L* 486DX2/50
IBM PS/2 Model 95 XP 486 9595-0M* 486DX/50
IBM PS/2 Model 95 XP 486 9595-xxx with
486DX2/66 Processor Upgrade
IBM PS/2 Model P75 8573-xxx 486DX/33
IBM PS/2 Server 85 9585-0X* with 486DX2/66
Processor Upgrade
IBM PS/2 Ultimedia DV M57 9557-xxx
486SLC2/50
IBM PS/2 Ultimedia M57 8557-xxx 386SLC/20
IBM PS/2 Ultimedia M57 9557-xxx 486SLC2/50
IBM PS/2 Ultimedia M77 9577-xxx 486DX2/66
IBM PS/2 Ultimedia M77 9577-xxx 486SX/33
IBM PS/ValuePoint 425SX/D 6384-Fxx
IBM PS/ValuePoint 425SX/S 6382-Fxx
IBM PS/ValuePoint 425SX/T 6387-Fxx
IBM PS/ValuePoint 433SX/D 6384-Kxx
IBM PS/ValuePoint 433SX/S 6382-Kxx
IBM PS/ValuePoint 433SX/T 6387-Kxx
IBM PS/ValuePoint 466DX2/D 6384-Wxx
IBM PS/ValuePoint 466DX2/T 6387-Wxx
ICL Alfaskop DS 458 Eisa
ICL CL486s/25
ICL CX486/33
ICL CXe486/66
ICL CXe486s
ICL FX486/66
ICL System Platform CXe486i
ICL System Platform FX486/33
ICL System Platform FX486/50
INDEXPORT 486/33
Intel® Express 486
Intel L486 Series Professional Workstation
Intel X486/50E
INTERCOMP Planet 486/50 EISA
INTERCOMP Target 486/33
Interface Electronic IEI 486DX/2 66Mhz EISA
System
International Technology 386DX/33 TEMPEST
Desktop System
International Technology 486DX/33 TEMPEST
Local Bus System
IPC DYNASTY HE 486DX-33C
IPC DYNASTY HE 486DX2- 66C
IPC DYNASTY HE 486DX2-50C
IPC DYNASTY HE 486SX-25C
IPC DYNASTY LE 486DX-33 (incl. 33C)
IPC DYNASTY LE 486DX2-50 (incl. 50C)
IPC DYNASTY LE 486DX2-66 (incl. 66C)
IPC DYNASTY LE 486SX-25 (incl. 25C)
IPC DYNASTY SE 486DX-33C
IPC DYNASTY SE 486DX2-50C
IPC DYNASTY SE 486DX2-66C
IPC DYNASTY SE 486SX-25C
Ipex 486DX33 Centra 1000 EISA
Ipex 486DX33 Centra 1000 EISA (Entry Level)
Ipex 486DX33 Centra 2000 EISA
Ipex 486DX33 Desktop
Ipex 486DX33 Desktop EISA
Ipex 486DX33 Desktop EISA (Entry Level)
Ipex 486DX33 Local Bus
Ipex 486DX33 Low Profile
Ipex 486DX33 Mini Tower
Ipex 486DX33 Mini Tower (EISA)
Ipex 486DX33 Mini Tower (Local Bus)
Ipex 486DX33 Mini Tower EISA (Entry Level)
Ipex 486DX50 Centra 1000 EISA
Ipex 486DX50 Centra 1000 EISA (Entry Level)
Ipex 486DX50 Centra 2000 EISA
Ipex 486DX50 Desktop
Ipex 486DX50 Desktop EISA
Ipex 486DX50 Desktop EISA (Entry Level)
Ipex 486DX50 Local Bus
Ipex 486DX50 Low Profile
Ipex 486DX50 Mini Tower
Ipex 486DX50 Mini Tower (EISA)
Ipex 486DX50 Mini Tower (Local Bus)
Ipex 486DX50 Mini Tower EISA (Entry Level)

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Ipex 486SX25 Centra 1000 EISA
Ipex 486SX25 Centra 2000 EISA
Ipex 486SX25 Desktop
Ipex 486SX25 Desktop EISA
Ipex 486SX25 Local Bus
Ipex 486SX25 Low Profile
Ipex 486SX25 Mini Tower
Ipex 486SX25 Mini Tower (EISA)
Ipex 486SX25 Mini Tower (Local Bus)
Iverson /ITC 486DX/33 TEMPEST Local Bus
EISA
Iverson 386DX/33 Desktop System
Iverson 386DX/33 MT System
Iverson 486DX/33 Local Bus Desktop System
Iverson 486DX/33 Local Bus RAT System
Iverson 486DX/50 Local Bus Desktop System
Iverson 486DX33 Local Bus FT System
Iverson 486DX50 Local Bus FT System
Iverson 486SX/25 Desktop System
Kyocera® EP-7000 (Multilight)
L.E.M. Technologies Sys38640/M
Leading Edge® 386/SX33 Desktop
Leading Edge D4/DX-33
Leading Edge D4/DX-33 Plus DeskTop
Leading Edge D4/DX-50 Plus DeskTop
Leading Edge D4/DX2-50 Plus DeskTop
Leading Edge D4/MTDX-33 MiniTower
Leading Edge D4/MTDX-50 MiniTower
Leading Edge D4/MTDX2-50 MiniTower
Leading Edge D4/MTSX-25 MiniTower
Leading Edge D4/MTSX-33 MiniTower
Leading Edge D4/SX-20
Leading Edge D4/SX-25 Plus DeskTop
Leading Edge D4/SX-33 Plus DeskTop
Leading Edge WinPro 486e/DX-33
Leading Edge WinPro 486e/DX-50
Leading Edge WinPro 486e/DX2-50
Leading Edge WinPro 486e/SX-25
Leading Edge WinPro 486e/SX-33
Lundin 400 Series 486 EISA
Lundin 400 Series 486 ISA
Master Cascade 386-40 Small Desktop
Master Cascade 486-33 Mini-Tower
Matcom 486 33 ISA QUANTUM
Maximus 486-50MHz Maxi-CAD
Maximus Cyrix 486/40 VESA Local Bus
MG CMOS Tower 486/50
Microbyte Lyrebird model 451
Microcomputation GAMA 486DX-33
Micronics Computers Gemini4-33
Micronics EISA2-50
Micronics VESA Local Bus
Mind 486DX/33 EISA
Mind 486DX/50
Mind 486DX/50 EISA
Mind 486SX/33 EISA
MiTAC 4060iT/M
MiTAC 4280H
Mustek MC3486
Mustek MC7486
National Instruments™ VXIpc-486 Model 200
National Instruments VXIpc-486 Model 500
NCR StarServer E
NCR StarStation
NCR System 3000 Model 3307
NCR System 3000 Model 3314
NCR System 3000 Model 3320
NCR System 3000 Model 3335
NCR System 3000 Model 3345
NCR System 3000 Model 3350
NCR System 3000 Model 3355
NCR System 3000 Model 3445
NCR System 3000 Model 3447
NEC® Image 425
NEC Image 433
NEC Image 466
NEC Powermate 386/25S
NEC PowerMate 425
NEC PowerMate 433
NEC PowerMate 466
NEC Powermate 486/33e
NEC PowerMate 486/33i
NEC PowerMate 486/50e
NEC PowerMate 486/50i
NEC Powermate 486sx/25e
NEC PowerMate 486SX/25i
NEC PowerMate DX2/50e
NEC PowerMate DX2/66e
NEC ProSpeed 486SX/C
NEC UltraLite™ Versa
Normerel Hexagone
Northgate® 386
Northgate 486/33
Northgate Elegance 333
Northgate Elegance 425i
Northgate Elegance 433e
Northgate Elegance 433i
Northgate Elegance SP 386/33
Northgate Elegance SP 433
Oki if486VX
Olivetti® LSX5010
Olivetti LSX5015
Olivetti LSX5020
Olivetti LSX5025
Olivetti M300-30
Olivetti M380-XP9
Olivetti M400-10
Olivetti M400-40
Olivetti M400-60
Olivetti M480-40

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Olympia Olystar 300D-33
Olympia Olystar 300S-33
Olympia Olystar 400D-33 EISA
Optima 486DX2/50 ISA
Osborne 486DX33
Osborne 486DX66
Osicom 4133L 486/DX266 VESA LB
Osicom 4133L 486/DX33 VESA LB
Packard Bell 400DX2/66 CACHE
Packard Bell 400T
Packard Bell 470
Packard Bell 485
Packard Bell 486CDM
Packard Bell 495
Packard Bell 515E
Packard Bell 525E
Packard Bell 545E
Packard Bell 550
Packard Bell 560
Packard Bell 566E
Packard Bell AXCEL 405 (incl. H model)
Packard Bell AXCEL 410
Packard Bell AXCEL 420
Packard Bell AXCEL 450
Packard Bell AXCEL 460
Packard Bell AXCEL 486/33
Packard Bell AXCEL 486A66
Packard Bell AXCEL 486SX
Packard Bell AXCEL 530
Packard Bell AXCEL 550
Packard Bell AXCEL 550MT/J
Packard Bell AXCEL 570
Packard Bell AXCEL 850
Packard Bell EXECUTIVE 486/33 (incl. ELITE model)
Packard Bell EXECUTIVE 486/33 EL (incl. F, and G models)
Packard Bell EXECUTIVE 486SX (incl. -2F and -G models)
Packard Bell EXECUTIVE 486SX ELITE (incl. ELITE SERIES SI model)
Packard Bell EXECUTIVE 486SX-4G
Packard Bell EXECUTIVE 486XE (incl. C and S models)
Packard Bell FORCE 405
Packard Bell FORCE 425
Packard Bell FORCE 486 SX (incl. E, -M1, and -M130 models)
Packard Bell FORCE 486/25 (incl. EX model)
Packard Bell FORCE 486/33 (incl. +, E, -M1, and -M210 models)
Packard Bell FORCE 486/33 (incl. G, J, JW, and PLUS models)
Packard Bell FORCE 48625
Packard Bell FORCE 486CDM-1/TV
Packard Bell FORCE 486MT50J
Packard Bell FORCE 486SX (incl. /20, /20G, E, M1, and M130 models)
Packard Bell FORCE 486SX/25 (incl. G and W models)
Packard Bell FORCE 515
Packard Bell FORCE 515S (incl. PLUS model)
Packard Bell FORCE 525 (incl. B and S models)
Packard Bell FORCE 545 (incl. B and S models)
Packard Bell FORCE 565 (incl. S model)
Packard Bell FORCE 600 (incl. B and S models)
Packard Bell LEGEND 486CDM-1/TV
Packard Bell LEGEND 625
Packard Bell LEGEND 660 (incl. ELITE and H models)
Packard Bell LEGEND 670
Packard Bell LEGEND 700 (incl. ELITE model)
Packard Bell LEGEND 740
Packard Bell LEGEND 750 SUPREME
Packard Bell LEGEND 770 (incl. ELITE model)
Packard Bell LEGEND 780
Packard Bell LEGEND 790
Packard Bell LEGEND 800 SUPREME
Packard Bell LEGEND 800 SUPREME/50
Packard Bell LEGEND 900 F (incl. F-ELITE, and G models)
Packard Bell LEGEND 920SX SUPREME
Packard Bell LEGEND 925 G (incl. ELITE and J model)
Packard Bell LEGEND 933 SUPREME (incl. G, G ELITE, J, J ELITE and J+)
Packard Bell LEGEND 950 (incl. ELITE model)
Packard Bell LEGEND 950J ELITE
Packard Bell LEGEND M950
Packard Bell LEGEND MT950J
Packard Bell LEGEND T66
Packard Bell PACKMATE 486
Packard Bell PACKMATE 486/33
Packard Bell PACKMATE 486/33J (incl. G model)
Packard Bell PACKMATE 486/50
Packard Bell PACKMATE 48625
Packard Bell PACKMATE 486SX
Packard Bell PACKMATE 486SX/20 E (incl. F, and G models)
Packard Bell PACKMATE 486SX/25G
Packard Bell PACKMATE X225
Packard Bell PACKMATE X230
Packard Bell PACKMATE X233
Packard Bell PACKMATE X240
Packard Bell PACKMATE X250 (incl. Y model)
Packard Bell PACKMATE XT266
Packard Bell PB-400DX-33 (with and without Cache)
Packard Bell PB-400DX2/50 (with and without

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Cache)
Packard Bell PB-400SX-20 (with and without Cache)
Packard Bell PB-400SX-25 (with and without Cache)
Packard Bell PB-486DX-33
Packard Bell PB-486DX2/50
Packard Bell PB-486SX-20
Packard Bell PB410SX-25
PC-Brand Leader 386dx/40 Cache
Philips® P3348 386sx-25
Philips P3371-II
Philips P3471
Poly 486-33E
Poly 486-33VZ
Poly 486-50E
Poly 486-50V
Poly 486-66E
Poly 486-66EV
Poly 486-66VI
Poly 486-66VL
Poly 486SX-25Y
Poly 486SX-33VL
Positive by Tandon 386dx/40
Powerhouse 486-25SX
Powerhouse 486-33DX
Precision 486/50 EISA
Pro Log 340 Series
Profesional Concepts Beeker 6900
Protech 386DX/40MHz ISA
Protech 386SX/33Mhz ISA
Protech 486/33MHz ISA
Protech 486/50Mhz ISA
Protech 486/66Mhz EISA
Protech 486/66Mhz ISA
Protech 486DX/50MHz EISA
Protech 486SX/25Mhz ISA
QNIX OMNI486DX33
Quadrant Pro 386
Quantex 386DX/40
Quantex 486DX/33
Quantex 486DX/33VL
Quantex 486DX/50
Quantex 486DX2/50
Quantex 486DX2/66
Quantex 486SX/25MPC
Rask REC 486-50F
RDIPC i486DX2/50c
RDIPC i486DX2/66c Eisa
RDIPC i486DX2/66c Isa
Reply Model 32
Research Machines RM E Series QE-486/33
Research Machines RM S Series PC-486/25SX
Research Machines RM SystemBase 486/33
Research Machines RM V Series V466
Samsung DeskMaster 486/50e
Samsung DeskMaster 486D2/66E
Samsung DeskMaster 486S/25N
Sanyo MBC-19te
Schneider 486DX-33
Schneider 486DX-50
SCI Systems 486sx25mhz VLSI
Seanix ASI 9000 386DX
Seanix ASI 9000 386SX
Seanix ASI 9000 486DX
Seanix ASI 9000 486LC1
Sho-tronics 486DX-33 LB
Sidus Formula 3/486i
Sidus Formula 486/50e
Sidus SCI model 486/33
Siemens-Nixdorf PCD-4GSX/25
Siemens-Nixdorf PCD-4RA/33
Siemens-Nixdorf PCD-4T/33
Siemens-Nixdorf PCD-4T/DX2-66
Siemens-Nixdorf PCE-4C/DX2-50
Siemens-Nixdorf PCE-4R/33
Siemens-Nixdorf PCE-4T/33
Sintaks SUBIS 486DX/50
Softworks Citus MDC 386-33
Softworks Citus MDC 486-25
Softworks Citus MDC 486DX-33
Softworks Citus MDC 486DX-50
Softworks Citus MDC 486DX2-50
Softworks Citus MDC 486DX2-66
Softworks Citus MDC X 486 50
Softworks Citus MDC386DX-40
Somelec ONYX VLD 433
SPC Ergoline 486DX/33
SPC Ergoline 486DX2/66
SPC Ergoline 486SX/33
STC CompuTech AT i386DX33
STC CompuTech AT i486DX266 ISA
STC CompuTech AT i486DX33 EISA
STC CompuTech AT i486DX50 ISA
Supercom Gmb-386SOP
Swan 486/50E
Swan 486DX2/66DB
Swan 486DX2/66ES
Swan 486SX/25DB
Syncomp Mega + 386i 33 PC
Syncomp Mega + 386i 40PC
Syncomp Mega + 486DX2i 50PC
Syncomp Mega + 486i 33 PC
Syncomp Mega + 486i 50ePC
Syncomp Mega + 486i 50PC
Syncomp Mega + 486SXi 25PC
Syncomp Micro 486DX2i 50PC
Syncomp Micro386i 33PC
Syncomp Micro386i 40PC
Syncomp Micro486i 33PC

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Syncomp Micro486i 50ePC
Syncomp Micro486i 50PC
Syncomp Micro486SXi 25PC
Syncomp Mini + 386i 33PC
Syncomp Mini + 386i 40PC
Syncomp Mini + 486DX2i 50PC
Syncomp Mini + 486i 33PC
Syncomp Mini + 486i 50ePC
Syncomp Mini + 486i 50PC
Syncomp Mini + 486SXi 25PC
Syncomp Mini 386i 33PC
Syncomp Mini 386i 40PC
Syncomp Mini 486DX2i 50PC
Syncomp Mini 486i 33PC
Syncomp Mini 486i 50ePC
Syncomp Mini 486i 50PC
Syncomp Mini 486SXi 25PC
Syncomp ProSport Portable
TaiPac Maxima 486-33-200
Tandon 386/40 Cache
Tandy® 2500SX/33
Tandy 425 SX
Tandy 433 DX
Tandy 433 SX
Tandy 450 DX2
Tandy 466 DX2
Tandy 4820 SX/T
Tandy 4825 SX
Tandy 4833 LX/T
Tandy 4850 EP
Tandy 4866 LX/T
Tangent 486DX/33 EISA
Tangent 486DX/33 ISA
Tatung TCA-8950T 386DX/33
Tatung TCS-8960S 386SX/25
Tatung TCS-9300T 486DX2/66
Tatung TCS-9360S 486SX/33
Tatung TCS-9370T 486DX2/66
Tatung TCS-9620E 486DX2/66
Tatung TCS-9650E 486DX2/66
Tatung TCS-9910S 486SLC/33
Terran Microbyte Lyrebird model 451
Texas Instruments® TravelMate™ 3000 Series
Texas Instruments TravelMate 4000 Series
Tiki-Data 486DX
Toshiba®T4400SX
Toshiba T6400
Towercom Micro Q 486DX-50MHz
Towercom Micro Q 486DX2-66MHz
TriGem 486/50F
TriGem TG 386DX/40C
TriGem TG 486/33F
TriGem TG 486/33MM
TriGem TG 486/50F(DX2)
TriGem TG 486/66F
TriGem TG 486DX2/50MM
TriGem TG SX486/25C
TriGem TG SX486/25MM
Tulip® Vision Line de/tr 486dx/33e
Tulip Vision Line de/tr 486dx/50
Tulip Vision Line de/tr 486dx/66
Tulip Vision Line dt 486dx/33
Tulip Vision Line dt 486sx
U.S. Micro Jet 386-33
U.S. Micro Jet 386-40
U.S. Micro Jet 486-33
U.S. Micro Jet 486-50
U.S. Micro Jet 486DLC-33
U.S. Micro Jet 486DX2-50
U.S. Micro Jet 486DX2-66
U.S. Micro Jet 486SX-25
U.S. Micro Jet EISA 486-33
U.S. Micro Jet EISA 486-50
U.S. Micro Jet EISA 486DX2-50
U.S. Micro Jet EISA 486DX2-66
U.S. Micro Jet VL 486DX2-66
U.S. Micro Jet VL 486SX-25
U.S. Micro Jet VL486-33
Ultra-Comp 386DX-25NC
Ultra-Comp 386DX-33I
Ultra-Comp 386SX-25
Ultra-Comp 486DX-33I
Ultra-Comp 486DX-50I
Ultra-Comp 486DX2-66I
Unidata 486 66 Mhz ISA
Unidata MX486 50 EISA
Unisys® PW2 Advantage 3256
Unisys PW2 Advantage 3336dx
Victor DX/50
Victor 400 DX/50
Victor 400 SX/25
Victor 486 DX/66
Victor 486DX/33
Victor V486DSX/25
Viglen Contender 4DX33
Viglen EX-Series
Viglen Genie 4DX33
Viglen Genie 4DX66
Vtech LASER 486DX-33 LOW PROFILE
Vtech LASER 486DX-33 TOWER
Vtech LASER 486DX2-55 LOW PROFILE
Vtech LASER 486DX2-55 TOWER
Vtech LASER 486DX2-66 LAN
Vtech LASER 486DX2-66 LOW PROFILE
Vtech LASER 486DX2-66 TOWER
Vtech LASER 486SX-25 LAN
Vtech LASER 486SX-25 LOW PROFILE
Vtech LASER 486SX-25 TOWER
Vtech LASER 486SX-33 LAN
Vtech LASER LT321E NOTEBOOK

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Wang® Microsystems ASI-CPU-E266
Wang Microsystems DTE-33
Wang Microsystems DTI-250
Wang Microsystems EC 480/33C
Wang Microsystems PC 350/40C
Wearnes 386SLC
Wedge 486dx-50 EISA
Western 486V25SX VESA LOCAL BUS
Western 486V33 DX
Western 486V33 DX EISA
Western 486V50 DX
Western 486V50 DX EISA
Western 486V50 DX2
Western 486V66 DX2
Western 486V66 DX2 EISA
Wyle Intel Xpress DeskSide w/486DX-50MHz
Wyle Intel Xpress DeskTop w/486DX-50MHz
Wyse® Decision 486/33
Wyse Decision 486/33E
Wyse Decision 486/33T
Wyse Decision 486se-25SX
Wyse Decision 486se-33DX
Wyse Decision 486se-33SX
Wyse Decision 486se-50DX2
Wyse Decision 486se-66DX2
Wyse Decision 486si-25SX
Wyse Decision 486si-33DX
Wyse Decision 486si-33SX
Wyse Decision 486si-50DX2
Wyse Decision 486si-66DX2
Wyse Series 6000i Model 640
Wyse Series 6000i Model 645
Wyse Series 7000i Model 740
Xycom 8450 Industrial Workstation
Zenith Data Systems Z-386/33
Zenith Data Systems Z-386/33E
Zenith Data Systems Z-386SX/20
Zenith Data Systems Z-433/DX
Zenith Data Systems Z-433/SX
Zenith Data Systems Z-450/DX
Zenith Data Systems Z-466/DX
Zenith Data Systems Z-486/25E
Zenith Data Systems Z-486/33E
Zenith Data Systems Z-486/33ET
Zenith Data Systems Z-486SX/20
Zenith Data Systems Z-486SX/25
Zenith Data Systems Z-486SX/25E
Zenith Data Systems Z-Note 325L
Zenith Data Systems Z-Note 425Ln
Zenith Data Systems Z-Server 433DE
Zenith Data Systems Z-Server 450DE
Zenith Data Systems Z-Server 566DE
Zenith Data Systems Z-Sport 325S
Zenith Data Systems Z-Station 420SEh (LN-140)
Zenith Data Systems Z-Station 450DEh

Zenith Data Systems Z-Station 466DEh
ZEOS® 386DX/33CDT
ZEOS 486DX/33CDT
ZEOS 486DX/33EISA
ZEOS 486DX/33ISA
ZEOS 486DX/50
ZEOS 486SX/20DT
ZEOS Upgradable Local Bus DX2-66

x86 Architecture Multiprocessor Computers

*The following multiprocessor systems
have been tested:*

ACER AcerFrame 1000 (Model 1750)
ACER AcerFrame 3000MP 33 (Model 3255)
ACER AcerFrame 3000MP 50 (Model 3257)
ALR POWERPRO DMP 4/33
ALR POWERPRO DMP 4/50
ALR PROVEISA DMP 4/33
ALR PROVEISA DMP 4/66D
AST Manhattan SMP
Compaq® Systempro® Dual 386/25
Compaq Systempro Dual 486/33
Compaq SystemPro Dual 486/50 XL
Compaq SystemPro Dual 486DX2/66
Corollary Extended C-bus 486DX2/66
ICL System Platform MX486/33
NCR System 3000 Model 3450³⁵
NCR System 3000 Model 3550³⁵
Siemens-Nixdorf PCE-4T/50(Dual)
Wyse Series 7000i Model 740MP/33
Wyse Series 7000i Model 740MP/66
Wyse Series 7000i Model 760MP

MIPS® ARC/R4000 Computers

*Any computer 100% compatible with
those listed below:*

ACER ARC1
Carrera R4000™
MIPS® ARCSytem Magnum PC
MIPS ARCSytem Magnum SC
Olivetti M700-10
Olivetti PWS4000

SCSI® Host Adapters

*The following SCSI adapters have
been tested with the following drives
(except as noted): CD Technologies*

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CD Porta-Drive T-3301; NEC Intersect CDR-74; Micropolis 1924; Peripheral Land Infinity 88; ArchiveST 4000 DAT.

Adaptec™ AHA-1510
Adaptec AHA-1520
Adaptec AHA-1522
Adaptec AHA-1540B²
Adaptec AHA-1542B²
Adaptec AHA-1542C
Adaptec AHA-1640
Adaptec AHA-1740³
Adaptec AHA-1742³
Adaptec AHA-1740A⁴
Adaptec AHA-1742A⁴
Adaptec AIC-6260⁵
BusLogic BT-542B
BusLogic BT-545S
BusLogic BT-640A
BusLogic BT-646S
BusLogic BT-742A
BusLogic BT-747S
DPT PM2011b (incl. cache)
DPT PM2012b (incl. cache)
Future Domain MCS-600
Future Domain MCS-700
Future Domain TMC-845⁶
Future Domain TMC-850
Future Domain TMC-850M(ER)
Future Domain TMC-860
Future Domain TMC-860M
Future Domain TMC-885
Future Domain TMC-1650
Future Domain TMC-1660
Future Domain TMC-1670
Future Domain TMC-1680
Future Domain TMC-7000EX
IBM PS/2 Microchannel SCSI Host Adapter⁷
IBM PS/2 Microchannel SCSI Host Adapter (with cache)
Maynard 16-Bit SCSI Adapter⁸
NCR 53C700 SCSI Adapter
NCR 53C710 SCSI Adapter
NCR 53C90 SCSI Controller^{9,10}
NCR 53C94 SCSI Controller¹¹
Olivetti ESC-1
Olivetti ESC-2¹²
Trantor T-128^{13,14,6}
Trantor T-130b^{13,6}
UltraStor 14f¹⁵
UltraStor 24f¹⁶
UltraStor 34f
UltraStor 124f¹⁷

Native SCSI adapter on MIPS ARC/R4000 systems from ACER, MIPS and Olivetti

SCSI CD-ROM Drives

The following CD-ROM drives have been tested with the following adapters: Adaptec AHA-1542b, AHA-1640, and AHA-1740A; Future Domain TMC-1670 and TMC-850M; IBM PS/2 Microchannel SCSI Host Adapter (with cache); UltraStor 24f.

CD-Technology CD Porta-Drive T-3301
CD-Technology CD Porta-Drive T-3401
Chinon CDX-431¹⁸
DEC RRD 42-DA
Denon® DRD 253
Hitachi® CDR-1750S¹⁹
IBM 3510¹⁸
NEC Intersect CDR-73M
NEC Intersect CDR-83M
NEC Intersect CDR-74
NEC Intersect CDR-84
Panasonic® CR-501B¹⁸
Pioneer® DRM-600²⁰
Sony® CDU-541²¹
Sony CDU-6211
Sony CDU-7211
Texel DM-5021¹⁸
Toshiba TXM-3201¹⁸
Toshiba TXM-3301
Toshiba TXM-3401

SCSI Tape Drives

The following tape drives have been tested with the following adapters: Adaptec AHA-1510, AHA-1542b, AHA-1640, and AHA-1740A; Future Domain TMC-1670 and TMC-850M; IBM PS/2 Microchannel SCSI Host Adapter (with cache); UltraStor 24f.

4 millimeter DAT
ArchiveST 4000DAT
Hewlett-Packard® JetStor 2000
Maynard MaynStream 1300DAT²²
Maynard 2000DAT²²
WangDAT Model 3200
Exabyte 8500

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Tandberg 3660
Tandberg 3820
Tandberg 4120

SCSI Removable Media

The following removable media (cartridge) drives have been tested with the following adapters (except as noted): Adaptec AHA-1542b, AHA-1640 and AHA-1740A; Future Domain TMC-1670 and TMC-850M; IBM PS/2 Microchannel SCSI Host Adapter (with cache); UltraStor 24f; all supported BusLogic adapters. Media must be mounted when booting Windows NT.

Insite 21mb Floptical
Iomega Bernoulli Transportable 150²³
Peripheral Land Infinity 40 Turbo
Peripheral Land Infinity 88
Quantum Passport XL
Syquest® 555 44mb cartridge
Syquest 5110 88mb cartridge

Disk Controllers

Any controller 100% register-compatible with the following:

Western Digital® 1003 (ESDI, IDE)
Compaq Intelligent Drive Array

Video Display Support

Drivers are included for the following video chip sets. Tested adapters are listed where applicable. Chip sets without an adapter have undergone preliminary testing and are expected to work, but some specific implementations might not. Please see the Release Notes for additional information. The following modes are supported:

A - 640x480x16
B - 640x480x256
C - 640x480x65,536
D - 640x480x16,777,216
E - 800x600x16

F - 800x600x256
G - 800x600x65,536
H - 800x600x16,777,216
I - 1024x768x16
J - 1024x768x256
K - 1024x768x65,536
L - 1152x900x256
M - 1152x900x65,536
N - 1280x1024x256

*driver supports both interlaced and non-interlaced displays
** driver supports interlaced displays only

Cirrus Logic

CL5426
Media Vision™ Thunder and Lightning [A, B, E, F, I, J]

CL5422

CL6410

CL6420

Dell DGX

Dell DGX Graphics Systems [B, C, F, G, J, K, L, M, N]

IBM

Standard VGA [A]

XGA® [B, J**]

XGA2 (PS/2 Model 77 Ultimedia) [J]

MIPS

Frame Buffer 300 [N]

Frame Buffer 364 [N]

VXL484/485 [B, C, D, F, G, H, J, K]

VXL485 [L, M, N]

S3

801

Actix Graphics ENGINE 32plus²⁴ [B, F, J]
911

Actix Graphics ENGINE²⁴ [B, F, J]

Diamond Stealth VRAM [B, F, J]

911A

Orchid Fahrenheit 1280 [B, F, J]

928

Number Nine #9GXE Level 11 [B, F, J]

Number Nine #9GXE Level 12 [B, F, J, N]

805

924

Trident

TVGA 8900C [A, B, E*, F*, I*, J*]

TVGA 9000a [A, E*, I*]

TVGA 8900CX

Tseng ET4000

ET4000AX

Diamond SpeedSTAR [A, B, E, F, I*, J*]

Orchid ProDesigner 2 [A, B, E, F, I*, J*]

Orchid ProDesigner IIs [A, B, E, F, I*, J*]

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VESA Super VGA
VESA-Compatible [E]
Video 7 VRAM
Headland Technology/Video Seven™ VRAM
VGA [A, E, I]
Headland Technology/Video Seven VRAM II
[A, B, E, F, I, J]
Western Digital/Paradise
WD90C30 [A, E, I]
WD90C31-ZS
Paradise Windows Accelerator [A**, E**,
I**]
WD90C31-LR [A, E, I]

Network Adapters

The following network adapters have undergone preliminary testing.²⁵ All ISA adapters in the following list have been tested on both x86 and MIPS platforms.

3Com® Etherlink II®
3Com Etherlink II/TP
3Com Etherlink/MC
3Com Etherlink® 16
3Com Etherlink II/16
Compaq 32-Bit NetFlex
Compaq 32-Bit DualSpeed Token-Ring
DEC® EtherWORKS LC
DEC EtherWORKS LC/TP
DEC EtherWORKS Turbo
DEC EtherWORKS Turbo/TP
DEC EtherWORKS Turbo EISA
IBM Token Ring 16/4
IBM Token Ring 16/4A
Intel EtherExpress™ 16
Novell® NE2000
Novell NE3200
Proteon P1390
Proteon P1990
SMC® (WD) EtherCard™ Plus (WD 8003EP)
SMC (WD) EtherCard Plus (WD 8013WB)
SMC (WD) EtherCard Plus Elite/A (WD
8013EP/A)
SMC (WD) EtherCard Plus Elite 16 (WD
8013EWC)
Ungermann-Bass® NIUpc
Ungermann-Bass NIUpc/EOTP
Ungermann-Bass NIUps

Native Ethernet adapter on MIPS ARC/R4000
systems from ACER, MIPS and Olivetti

Multimedia Audio Adapters

The following audio adapters have undergone preliminary testing:

Creative Labs SoundBlaster™ 1.x
Creative Labs SoundBlaster Pro™²⁶
Media Vision Pro Audio Spectrum^{26,27}
Media Vision Pro Audio Spectrum-16^{26,27}
Media Vision Thunder Board²⁶
Microsoft Windows™ Sound System

Native sound adapter on MIPS ARC/R4000
systems from ACER and MIPS

Modems

The following modems have undergone preliminary testing:

ATI 2400 etc/e
ATI 9600 etc/e
AT&T® Paradyne ARK DM 424
AT&T Comsphere 3810
AT&T Comsphere 3811
AT&T Comsphere 3820
AT&T Comsphere 3830
AT&T Dataport
AT&T 4024
Bocamodem M1440
Cardinal 9600
Codex 2264
Codex 3220
Codex 3260
Codex 3261
Codex 3262
Codex 3263
Codex 3265
Codex 3260 Fast
Codex 3261 Fast
Codex 3262 Fast
Codex 3263 Fast
Codex 3265 Fast
Codex 3220 Plus
Digicom Scout
Digicom Scout Plus
Evercom 24
Evercom 24E
Evercom 24E+
Gateway 2000 Telepath Internal
GVC SM2400
GVC SM96
GVC FM14400
Hayes® Compatible 1200
Hayes Compatible 2400
Hayes Compatible 9600

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Hayes Smartmodem 2400™
Hayes Smartmodem™ 9600
Hayes Optima 9600
Hayes Optima 14400
Hayes Ultra 9600
Hayes Ultra 14400
Hayes V Series 9600
Intel SatisFAXtion® 400e²⁸
Intel 9600EX
Megahertz P2144 Pocket Faxmodem^{28,29}
MicroComQX 4232bis³⁰
MicroComQX 4232HS³¹
MicroPorte 1042
NEC 9635E Plus
Null Modem 4800
Null Modem 9600
Null Modem 19200
Null Modem 38400
Practical Peripherals 2400SA³²
Practical Peripherals 9600SA
Practical Peripherals 14400SA
Racal-Milgo 2412
Racal-Milgo 3222
Racal-Vadic 9632PA
Racal-Vadic 9642PA
SupraModem 2400
Supra Fax Modem V32²⁸
Supra Fax Modem V32bis²⁸
Supra Fax Modem Plus²⁸
Telebit QBlazer
Telebit T1500³³
Telebit T1600
Telebit T2000
Telebit T2500
Telebit T3000
Telebit TrailBlazer® Plus
Telebit WorldBlazer
UDS Motorola® V.3227
UDS Motorola V.3229
UDS Motorola FasTalk V.32/42b
US Robotics Courier Dual
US Robotics Courier HST
US Robotics Courier V.32bis
US Robotics Sportster 2400
Zoom AFX
Zoom FX 9624V
Zoom VFX V.32bis
ZyXel U-1496
ZyXel U-1496E

Multi-port Serial Adapters

The following multi-port adapters have been tested:

DigiBoard DigiCHANNEL PC/X Host
Adapter for ISA bus

Stargate Technologies Plus 8
Control Hostess 550

Uninterruptable Power Supplies

The following Uninterruptable Power Supplies have been tested:

American Power Conversion Back-UPS
American Power Conversion Smart-UPS
Para Systems AT800
Tripp Lite BC800LAN³⁴
Unison (Tripp Lite) UNIPower PS 6.0 & 8.0

Pointing Devices

The following mice have been tested:

Acer M-SG14
AT&T 320 Mouse CA-93-6MD
CompuAdd Serial Mouse
Digital Equipment PCXAS-AA
Hewlett-Packard C1413A
Logitech™ Bus Mouseman
Logitech Cordless Mouseman
Logitech M-MD14-2
Logitech M-MD15L
Logitech Serial Mouseman
Microsoft BallPoint®
Microsoft Inport Mouse
Microsoft Mouse (Original)
Microsoft PS/2 Compatible Mouse
Microsoft Serial Mouse
Microsoft Serial / PS/2 Mouse
MotorMouse
Olivetti M-SE9-6MD

Keyboards

Any keyboard 100% compatible with those listed below:

101/102-key
IBM AT® (84-key)

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Printers

There are drivers included for the following printers. Models with a # preceding have been tested.

Adobe® LaserJet II Cartridge v52.3
Agfa Compugraphic Genics
Agfa Matrix ChromaScript v51.8
Agfa TabScript C500 PostScript Printer v50.3
Agfa-Compugraphic 9400P v49.3
Apple® LaserWriter® II NT v47.0
#Apple LaserWriter II NTX v51.8
Apple LaserWriter II NTX v51.8
Apple LaserWriter II NTX-J v50.5
Apple LaserWriter Iif v2010.113
Apple LaserWriter IIg v2010.113
Apple LaserWriter Plus v38.0
Apple LaserWriter Plus v42.2
Apple LaserWriter v23.0
Apple Personal LaserWriter NTR v2010.129
Apricot Laser
APS-PS PIP with APS-6-108 v49.3 or 52.2
APS-PS PIP with APS-6-80 v49.3 or 52.2
APS-PS PIP with LZR 1200 v49.3 or 52.2
APS-PS PIP with LZR 2600 v49.3 or 52.2
AST TurboLaser-PS v47.0
AT&T® 470/475
AT&T 473/478
Brother® HJ-100
Brother HJ-100i
Brother HJ-770
Brother HL-10DV
Brother HL-10V
Brother HL-4V
Brother HL-4Ve
Brother HL-8V
Brother M-1309
Brother M-1324
Brother M-1809
Brother M-1818
Brother M-1824L
Brother M-1909
Brother M-1918
Brother M-1924L
Bull Compuprint PageMaster 413
Bull Compuprint PM 201
C-Ittoh® 8510
Canon® Bubble-Jet BJ-10e
Canon Bubble-Jet BJ-10ex
Canon Bubble-Jet BJ-10sx
Canon Bubble-Jet BJ-130
Canon Bubble-Jet BJ-130e
Canon Bubble-Jet BJ-20
Canon Bubble-Jet BJ-200
Canon Bubble-Jet BJ-300

#Canon Bubble-Jet BJ-330
Canon Bubble-Jet BJC-800
Canon LBP-4 PS-2 v51.4
Canon LBP-8III PS-1 v51.4
Canon LBP-8IIIR PS-1 v51.4
Canon LBP-8IIIT PS-1 v51.4
Canon PS-IPU Color Laser Copier v52.3
Canon PS-IPU Kanji Color Laser Copier v52.3
Citizen 120D
Citizen 120D+
Citizen 124D
Citizen 180D
Citizen 200GX
Citizen 200GX/15
Citizen 224
Citizen GSX 240 Scalable Font
Citizen GSX-130
Citizen GSX-140
Citizen GSX-140+
Citizen GSX-145
Citizen GSX-230
Citizen HSP-500
Citizen HSP-550
Citizen PN48
Citizen Prodod 24
Citizen Prodod 9
Citizen Prodod 9x
Citizen PROjet
Citizen Swift 200
Citizen Swift 24
Citizen Swift 240 Scalable Font
Citizen Swift 24e
Citizen Swift 24x
Citizen Swift 9
Citizen Swift 9x
Colormate PS v51.9
Compaq PAGEMARQ 15 v2012.015
Compaq PAGEMARQ 20 v2012.015
Dataproducts LZR 1260 v47.0
Dataproducts LZR 1560 v2010.127
Dataproducts LZR 960 v2010.106
Dataproducts LZR-2665 v46.2
Diconix 150 Plus
Digital Colormate PS v51.9
Digital DEClaser 1100 (LJ)
Digital DEClaser 1150 v51.4
Digital DEClaser 1152 (43 fonts) v2011.113
Digital DEClaser 1152 (17 fonts) v2011.113
Digital DEClaser 2100plus (LJ)
Digital DEClaser 2150 v51.4
Digital DEClaser 2150 plus v51.4
Digital DEClaser 2200 plus (LJ)
Digital DEClaser 2250 v51.4
Digital DEClaser 2250 plus v51.4
Digital DEClaser 3200 (LJ)

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Digital DEClaser 3250 v47.0	Epson LQ-1010
Digital DECmultiJET 1000	Epson LQ-1050
Digital DECmultiJET 2000	Epson LQ-1060
Digital DECwriter 95	Epson LQ-1070 Scalable Font
Digital LA310	Epson LQ-1170 Scalable Font
Digital LA324	Epson LQ-1500
Digital LA424	Epson LQ-200
Digital LA70	#Epson LQ-2500
Digital LA75 Plus	#Epson LQ-2550
Digital LA75	Epson LQ-400
Digital LN03R ScriptPrinter v47.2	Epson LQ-450
Digital PrintServer 17 v48.3	Epson LQ-500
Digital PrintServer 20 v48.3	#Epson LQ-510
Digital PrintServer 32 v48.3	Epson LQ-550
Digital PrintServer 40 Plus v48.3	Epson LQ-570 Scalable Font
Digital turbo PrintServer 20 v48.3	Epson LQ-800
Epson ActionLaser II	Epson LQ-850
Epson AP-3250 Scalable Font	Epson LQ-860
Epson AP-5000 Scalable Font	Epson LQ-870 Scalable Font
Epson AP-5500 Scalable Font	Epson LQ-950
Epson Compatible 24 Pin	Epson LX-80
Epson Compatible 9 Pin	Epson LX-800
Epson DFX-5000	Epson LX-810
Epson DLQ-2000	Epson LX-850
Epson EPL-4000	Epson LX-850+
Epson EPL-4300	Epson LX-86
Epson EPL-6000	Epson MX-100
Epson EPL-7000	Epson MX-80 F/T
Epson EPL-7500 v52.3	Epson MX-80
Epson EPL-8000	EPSON PostScript CARD v52.5
Epson EPL-8100	Epson RX-100
Epson EX-1000	Epson RX-100+
Epson EX-800	Epson RX-80 F/T
Epson FX™-100	Epson RX-80 F/T+
Epson FX-100+	Epson RX-80
Epson FX-1000	Epson SQ-1170 Scalable Font
Epson FX-105	Epson SQ-2000
Epson FX-1050	Epson SQ-2500
Epson FX-185	Epson SQ-2550
Epson FX-286	Epson SQ-850
Epson FX-286e	Epson SQ-870 Scalable Font
Epson FX-80	Epson T-750
Epson FX-80+	Fujitsu® Breeze 100
Epson FX-800	Fujitsu Breeze 200
#Epson FX-85	Fujitsu DL 1100 Colour
Epson FX-850	Fujitsu DL 1100
Epson FX-86e	Fujitsu DL 1150
Epson GQ-3500	Fujitsu DL 1200
Epson JX-80	Fujitsu DL 1250
Epson L-1000	Fujitsu DL 2400
Epson L-750	Fujitsu DL 2600
Epson LP-3000PS F2 v52.3	Fujitsu DL 3300
Epson LP-3000PS F5 v52.3	Fujitsu DL 3350
Epson LQ-100 Scalable Font	Fujitsu DL 3400
Epson LQ-1000	Fujitsu DL 3450

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Fujitsu DL 3600
Fujitsu DL 4400
Fujitsu DL 4600
Fujitsu DL 5600
Fujitsu DL 900
Fujitsu DX 2100
Fujitsu DX 2200
Fujitsu DX 2300
Fujitsu DX 2400
Fujitsu RX7100PS v50.3
GCC BLP Elite v52.3
GCC BLP II v52.3
GCC BLP IIS v52.3
GCC Business LaserPrinter v49.2
GCC Business LaserPrinter v51.4
Gestetner GLP800-Scout v52.3
Hermes H 606 PS (13 Fonts)
Hermes H 606 PS (35 fonts)
#HP DeskJet® 500
HP DeskJet 500C (Monochrome)
HP DeskJet 500C
HP DeskJet 550C
HP DeskJet Plus
HP DeskJet Portable
HP DeskJet
HP LaserJet® 2000
#HP LaserJet 4
HP LaserJet 4 PostScript v2011.110
HP LaserJet 500+
HP LaserJet ELI PostScript v52.3
HP LaserJet IID PostScript Cartridge v52.2
#HP LaserJet IID
HP LaserJet III PostScript Cartridge v52.2
HP LaserJet III PostScript Plus v2010.118
#HP LaserJet III
HP LaserJet IIID PostScript Cartridge v52.2
HP LaserJet IIID PostScript Plus v2010.118
#HP LaserJet IIID
#HP LaserJet IIIP PostScript Cartridge v52.2
HP LaserJet IIIP PostScript Plus v2010.118
#HP LaserJet IIIP
#HP LaserJet IIISi PostScript v52.3
#HP LaserJet IIISi
HP LaserJet IIP Plus
#HP LaserJet IIP PostScript Cartridge v52.2
#HP LaserJet IIP
HP LaserJet Plus
#HP LaserJet Series II
HP LaserJet
#HP PaintJet® XL
HP PaintJet XL300 v2011.112
#HP PaintJet
HP QuietJet® Plus
HP QuietJet
HP ThinkJet® (2225 C-D)

IBM 4019 17 fonts v52.3 or 52.1
#IBM 4019 39 fonts v52.3 or 52.1
IBM 4029 with 17 Fonts v52.3
IBM 4029 with 39 Fonts v52.3
IBM 4070 IJ
IBM 4216-020 v47.0
IBM 4216-030 v50.5
IBM ExecJet® 4072
IBM Graphics
IBM Personal Printer II 2380
IBM Personal Printer II 2381
IBM Personal Printer II 2390
IBM Personal Printer II 2391
IBM Portable 5183
#IBM Proprinter® II
IBM Proprinter III
IBM Proprinter X24
IBM Proprinter X24e
IBM Proprinter XL II
IBM Proprinter XL III
#IBM Proprinter XL
IBM Proprinter XL24
IBM Proprinter XL24e
#IBM Proprinter
IBM PS/1 2205
#IBM QuickWriter® 5204
IBM QuietWriter® III
Kodak® EktaPlus 7016
Kyocera F-1000
Kyocera F-1000A
Kyocera F-1010
Kyocera F-1200S
Kyocera F-1800
Kyocera F-1800A
Kyocera F-2000A
Kyocera F-2010
Kyocera F-2200
Kyocera F-2200S
Kyocera F-3000
Kyocera F-3000A
Kyocera F-3010
Kyocera F-3300
Kyocera F-5000
Kyocera F-800
Kyocera F-800A
Kyocera F-820
Kyocera FS-1500 / FS-1500A
Kyocera FS-3500 / FS-3500A
Kyocera FS-5500 / FS-5500A
Kyocera FS-850 / FS-850A
LaserWriter Personal NT v51.8
Linotronic™ 100 v42.5
Linotronic 200 v47.1
Linotronic 200 v49.3
Linotronic 200/230

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Linotronic 300 v47.1
Linotronic 300 v49.3
Linotronic 330 v52.3
Linotronic 330-RIP 30 v52.3
Linotronic 500 v49.3
Linotronic 530 v52.3
Linotronic 530-RIP 30 v52.3
Linotronic 630 v52.3
Mannesmann Tally® MT 130/24
Mannesmann Tally MT 131/24
Mannesmann Tally MT 150/24
Mannesmann Tally MT 151/24
Mannesmann Tally MT 230/24
Mannesmann Tally MT 330
Mannesmann Tally MT 350
Mannesmann Tally MT 360
Mannesmann Tally MT 730/735
Mannesmann Tally MT 82
Mannesmann Tally MT 90
Mannesmann Tally MT 904 Plus
Mannesmann Tally MT 908
Mannesmann Tally MT 91
Mannesmann Tally MT 92
Mannesmann Tally MT 92C
Mannesmann Tally MT 93
Mannesmann Tally MT 94
Mannesmann Tally MT 98/99
Microtek TrueLaser
Minolta SP 3000
Minolta SP 3500
Monotype® ImageMaster 1200 v52.3
Monotype Imagesetter v52.2
NEC Colormate PS/40 v51.9
NEC Colormate PS/80 v51.9
NEC Pinwriter CP6
NEC Pinwriter CP7
NEC Pinwriter P20
NEC Pinwriter P2200
NEC Pinwriter P2plus
NEC Pinwriter P30
NEC Pinwriter P3200
NEC Pinwriter P3300
NEC Pinwriter P5200
#NEC Pinwriter P5300
NEC Pinwriter P5XL
NEC Pinwriter P6
NEC Pinwriter P60
NEC Pinwriter P6200
NEC Pinwriter P6300
NEC Pinwriter P6plus
NEC Pinwriter P7
NEC Pinwriter P70
NEC Pinwriter P7plus
NEC Pinwriter P90
NEC Pinwriter P9300
NEC Pinwriter P9XL
NEC SilentWriter 95 v2010.119
NEC Silentwriter 95 v2011.111
NEC Silentwriter 97 v2011.111
NEC Silentwriter LC 860 Plus
NEC Silentwriter LC 860
NEC Silentwriter LC890 v47.0
NEC Silentwriter LC890XL v50.5
NEC Silentwriter2 290 v52.0
NEC Silentwriter2 90 v52.2
NEC Silentwriter2 990 v52.3
NeXT® 400 dpi Laser Printer v2000.6
OceColor G5241 PS
OceColor G5242 PostScript Printer v50.3
Oki MICROLINE 801PS+F v52.3
Oki ML 182 Elite (IBM)
Oki ML 192 Elite (IBM)
Oki ML 193 Elite (IBM)
Oki ML 280 Elite (IBM)
Oki ML 320 Elite (IBM)
Oki ML 321 Elite (IBM)
Oki ML 3410 Elite (IBM)
Oki ML 380 Elite
Oki ML 390 Elite
Oki ML 391 Elite
Oki ML 393 Elite
Oki ML 393C Elite
Oki OL-400
Oki OL-410
Oki OL-800/840
Oki OL-810
Oki OL830-PS v52.5
Oki OL840-PS v51.8
Okidata® LaserLine 6
Okidata ML 192 Plus
Okidata ML 192
Okidata ML 193 Plus
Okidata ML 193
Okidata ML 292
Okidata ML 293
Okidata ML 320
Okidata ML 321
Okidata ML 380
Okidata ML 390 Plus
Okidata ML 390
Okidata ML 391 Plus
Okidata ML 391
Okidata ML 393 Plus
Okidata ML 393
Okidata ML 393C Plus
Okidata ML 393C
Okidata ML 92-IBM
Okidata ML 93-IBM
Okidata OL-400
Okidata OL-800

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Olivetti DM 109
Olivetti DM 124 C
Olivetti DM 124 L
Olivetti DM 124
Olivetti DM 309 L
Olivetti DM 309 S
Olivetti DM 309 SL
Olivetti DM 309
Olivetti DM 324 L
Olivetti DM 324 S
Olivetti DM 324 SL
Olivetti DM 324
Olivetti DM 600 S
Olivetti DM 600
Olivetti DM 624
Olivetti ETV 5000
Olivetti JP 150
Olivetti JP 350
Olivetti JP 350S
Olivetti PG 108
Olivetti PG 208 M2
Olivetti PG 306 PS (13 Fonts)
Olivetti PG 306 PS (35 Fonts)
Olivetti PG 306
Olivetti PG 308 HS
Olivetti PG 308
Olivetti PG 404
Olivetti PG 408
Panasonic® KX-P1081
Panasonic KX-P1123
Panasonic KX-P1124
Panasonic KX-P1124i
Panasonic KX-P1180
Panasonic KX-P1624
Panasonic KX-P1695
Panasonic KX-P2123
Panasonic KX-P2124
Panasonic KX-P2180
Panasonic KX-P2624
Panasonic KX-P4410
Panasonic KX-P4420
Panasonic KX-P4430
Panasonic KX-P4450i
Panasonic KX-P4451
Panasonic KX-P4455 v51.4
#QMS ColorScript™ 100 Model 10 v50.3
QMS ColorScript 100 Model 20 v50.3
QMS ColorScript 100 Model 30 v50.3
QMS ColorScript 100 v49.4
QMS PS® Jet Plus v46.1
QMS PS Jet v46.1
QMS-PS 1700 v52.4
QMS-PS 2000 v52.4
QMS-PS 2200 v51.0 or 52.3
QMS-PS 2210 v51.0 or 52.3
QMS-PS 2220 v51.0 or 52.3
QMS-PS 410 v52.4
QMS-PS 800 Plus v46.1
QMS-PS 800 v46.1
#QMS-PS 810 Turbo v. 51.7
#QMS-PS 810 v47.0
QMS-PS 815 MR v52.4
QMS-PS 815 v52.4
QMS-PS 820 Turbo v51.7
QMS-PS 820 v51.7
QMS-PS 825 MR v52.4
QMS-PS 825 v52.4
QuadLaser I
Qume ScripTEN v47.0
Ricoh LP-1200
Ricoh PC Laser 6000-PS v50.5
Scantext 2030-51 v49.3 or 52.2
Schlumberger 5232 Color PostScript Printer v50.3
#Seiko ColorPoint 8BPP
Seiko ColorPoint PS Model 04
Seiko ColorPoint PS Model 14
Seikosha LT-20
Seikosha SL-80 IP
Seikosha SL-92 Plus
Seikosha SL-92
Seikosha SP-1900
Seikosha SP-1900+
Seikosha SP-2000
Seikosha SP-2400
Seikosha SP-2415
Sharp JX-9300
Sharp JX-9500
Sharp JX-9500E
Sharp JX-9500H
Sharp JX-9600
Sharp JX-9700
Sharp JX-9700E
Shinko Color CHC-746PSJ PostScript Printer
v52.2
Silentwriter LC 890 v47.0
Silentwriter LC 890XL v50.5
Silentwriter2 290 v52.0
Silentwriter2 Model 90 v52.2
Star FR-10
Star FR-15
Star LaserPrinter 4 III
Star LaserPrinter 4
Star LaserPrinter 5 EX
Star LaserPrinter 5
Star LaserPrinter 8 DB
Star LaserPrinter 8 DX
Star LaserPrinter 8 II
Star LaserPrinter 8 III
Star LaserPrinter 8
Star LC-10 Colour

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Star LC-10	TI 2115 35 fonts v47.0
Star LC-15	TI 850/855
Star LC-20	TI microLaser PS17 v.52.1
Star LC-200	TI microLaser PS35 v.52.1
Star LC24-10	TI microLaser XL PS17 v.52.1
Star LC24-100	TI microLaser XL PS35 v.52.1
Star LC24-15	TI microLaser16 Turbo v2010.119
Star LC24-20	TI microLaser6 Turbo v2010.119
Star LC24-200 Colour	TI microLaser9 Turbo v2010.119
Star LC24-200	TI OmniLaser 2108 v45.0
Star NB24-10	TI Omnilaser 2115 v47.0
Star NB24-15	Toshiba GX-400
Star NL-10	Toshiba P1351
Star NX-1000 Rainbow	Toshiba P351
Star NX-1000	Toshiba PageLaser12
Star NX-1001	Triumph Adler SDR 7706 PS13
Star NX-1020 Rainbow	Triumph Adler SDR 7706 PS35
Star NX-1500	Unisys® AP9210 17 Fonts v52.1
Star NX-2400	Unisys AP9210 39 Fonts v52.1
Star NX-2410	Unisys AP9210
Star NX-2415	Unisys AP9415 v47.0
Star NX-2420 Rainbow	Varietyper 4000-L300 v52.3
Star NX-2420	Varietyper 4000-L330 v52.3
Star NX-2430	Varietyper 4000-L500 v52.3
Star SJ-48	Varietyper 4000-L530 v52.3
Star XB-2410	Varietyper 4200B-P v49.3 or 52.2
Star XB-2415	Varietyper 4300P v49.3 or 52.2
Star XB-2420	Varietyper Series 4000-5300 v49.3 or 52.2
Star XB-2425	Varietyper Series 4000-5330 v49.3 or 52.2
Star XB24-10	Varietyper Series 4000-5500 v52.2
Star XB24-15	Varietyper VT-600P v48.0
Star XB24-200	Varietyper VT-600P
Star XB24-250	Varietyper VT-600W v48.0
Star XR-1000	Varietyper VT4990 v52.3
Star XR-1020	Varietyper VT4_510A v52.3
Star XR-1500	VT4_530A v52.3
Star XR-1520	VT4_530B v52.3
Star ZA-200	VT4_530C v52.3
Star ZA-250	VT4_533B v52.3
Tandy LP-1000	VT4_533C v52.3
Tegra Genesis	VT4_53EA v52.3
Tektronix® Phaser™ II PX	VT4_53EB v52.3
Tektronix Phaser II PXe v2010.128 with 17 fonts	VT4_550A v52.3
Tektronix Phaser II PXe v2010.128 with 39 fonts	VT4_550B v52.3
Tektronix Phaser II PXi v2010.116	VT4_550C v52.3
Tektronix Phaser II PXi v2011.108	VT4_551A v52.3
Tektronix Phaser II PXiJ v2011.108	VT4_563A v52.3
Tektronix Phaser III PXi v2010.116	VT4_563B v52.3
#Tektronix Phaser III PXi v2011.108	Wang® LDP8
Tektronix Phaser III PXiJ v2011.108	Xerox® DocuTech 135 v2010.130
Tektronix Phaser IISD v2011.108	Xerox DocuTech 85 v2010.130
Tektronix Phaser PX	Xerox DocuTech 90 v2010.130
TI® 2115 13 fonts v47.0	

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- 1 This machine experienced serial port transmission failures.
 - 2 Tested with firmware revisions 3.10 and 3.20.
 - 3 This adapter must be configured for 5 MB/second asynchronous I/O to work with listed CD-ROM drives from NEC.
 - 4 This adapter must be configured for 5 MB/second asynchronous I/O to work with listed CD-ROM drives from Chinon, Hitachi, and NEC.
 - 5 Tested with Unisys PW2Advantage 3256 (Flemington).
 - 6 To use this adapter, at least one device on the bus must provide termination power.
 - 7 This adapter does not support 4mm DAT drives.
 - 8 The Maynard SCSI Controller can be used as a general purpose SCSI controller for all tasks except CD Setup. To install Windows NT with this adapter, use the WINNT.EXE Setup method.
 - 9 Tested with NCR System 3000 Model 3320 and Compaq Portable 486c.
 - 10 The NCR System 3000 Model 3320 with this SCSI controller does not support tape backup.
 - 11 Tested with NCR System 3000 Model 3350.
 - 12 This adapter must be configured for asynchronous I/O to work with NEC Intersect CDR-73(M) and Pioneer DRM-600 CD-ROM drives.
 - 13 This adapter is supported only on IRQ 5.
 - 14 This adapter does not support tape drives.
 - 15 Contact UltraStor for an upgrade if you encounter CD-ROM problems.
 - 16 Contact UltraStor for an upgrade if you encounter tape drive problems.
 - 17 The UltraStor 124f is a RAID controller. It supports hard drives and removable media drives only.
 - 18 CD audio is not supported on this drive.
 - 19 Soft (recoverable) errors may occur when used with Future Domain 8xx series adapters.
 - 20 The Adaptec AHA-1640 only supports a single compact disc when used with this CD-ROM drive.
 - 21 CD Audio is not supported on Sony CD-ROM drives when used with the Adaptec AHA-1640.
 - 22 This drive is not supported with the Adaptec AHA 1640 adapter.
 - 23 Not supported with Adaptec AHA-174x adapters.
 - 24 Supported in 72hz refresh rate only.
 - 25 Full NDIS 3.0 conformance testing will be available in the future through Microsoft Compatibility Labs.
 - 26 Supported in SoundBlaster 1.x emulation mode only.
 - 27 The external MIDI connector on this adapter is not supported.
 - 28 FAX communications not supported.
 - 29 MAXCONNECTBPS in MODEM.INF must be set to 9600.
 - 30 Advanced features must be disabled and MAXCONNECT set to 19200.
 - 31 Advanced features must be disabled and MAXCONNECT set to 9600.
 - 32 Works as a client modem only.
 - 33 PEP must be disabled on all Telebit modems.
 - 34 Using the UPS applet, check the box "Remote UPS Shutdown" and set it to high.
 - 35 Only the NCR 53c710 SCSI Host Adapter is supported in this machine.

While we have endeavored to supply as complete and accurate a list as possible, MICROSOFT MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AS TO THE COMPLETENESS AND ACCURACY OF THIS LIST. This list does not constitute an endorsement of any particular manufacturer.

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Microsoft® OS/2® Version 1.3 Hardware Compatibility List

The following computers, video displays, printers, pointing devices, keyboards, storage devices, and disk adapters have been tested by Microsoft or the manufacturer and have no known incompatibilities with Microsoft OS/2 version 1.3. Items marked with an asterisk (*) have passed additional Microsoft Compatibility Labs certification testing and have full test reports available on CompuServe and via the Microsoft Download Service. This list was current at the time it was published. Additional systems may have been tested subsequent to publication, and device drivers may be available for peripherals not listed below. To obtain information regarding either instance, please refer to the README.TXT file in the \OS2\SUPPORT directory. The most recent version of this list, or a test report on any certified hardware, is available via the Microsoft Download Service at (206) 936-6735.

Computers

Any computer 100% compatible with those in the following list. (Other computers may be compatible, but they have not been tested.)

ACER 1100/33
ACER 1120sx
ACER 1120sx
ACER 1125E
ACER 1170
ACER Power 486sx
ACERPower 500 486sx/20
ADD-X AS325
Adler Royal P35
Adler Royal P45
ALR BusinessStation 386/33
ALR BusinessStation 486/25
ALR BusinessStation 486/33
ALR BusinessVEISA 386/33
ALR BusinessVEISA 486/33
ALR BusinessVEISA 486ASX
ALR MPS 386/33
ALR MPS 486/33
ALR PowerCache 4 25
ALR PowerCache 4 33
ALR PowerCache 4e
ALR PowerFlex 20 CSX
ALR PowerPro 128/150 SMP Series
ALR PowerPro DMP (256150)
ALR PowerPro VM/64
ALR PowerVEISA 386/33
ALR PowerVEISA 486/33
ALR SX PowerFlex
Apricot FTe 486-33 *
Apricot LS 386SX-20 *
Apricot XEN-LS 486SX-20 *
AST Premium 386/25
AST Premium 386/33TE
AST Premium 486/33E
AST Premium 486/33TE
AST Premium II 486/33
AT&T 6386/25 WGS
AT&T 6386E WGS
AT&T 6386E/33 model S WGS
AT&T 6386E/33 WGS
AT&T 6386SX WGS
AT&T 6386SX/EL
AT&T 6386SX/EL 20
AT&T StarServer E
AT&T StarServer S
AT&T StarStation
Bull Micral 200
Bull Micral 400
Bull Micral 45
Bull Micral 500
Bull Micral 600
Bull Micral 75
Cemtech CEMServer 1 CEM-486(33)IS *
Compaq Deskpro 286n
Compaq Deskpro 386/16
Compaq Deskpro 386/20
Compaq Deskpro 386/20e *
Compaq Deskpro 386/25
Compaq Deskpro 386/25e *
Compaq Deskpro 386/25M
Compaq Deskpro 386/33
Compaq Deskpro 386/33L *
Compaq Deskpro 386n *
Compaq Deskpro 386s/20
Compaq Deskpro 486/33L *
Compaq Deskpro 486/33M
Compaq Deskpro 486/50L
Compaq Deskpro 486s/16M
Compaq Deskpro 486s/25M
Compaq LTE 386s/20
Compaq ProSignia 486/33 *
Compaq SLT 386s/20
Compaq SystemPro 386/33 *
Compaq SystemPro 486/33 *
CompuAdd Model 320SC
CompuAdd Model 333LP
CompuAdd Model 333T
CompuAdd Model 433E
CompuAdd Model 466E *
DECpc 320 SX Notebook
DECpc 333 Portable
DECstation 320sx
DECstation 333c
DECstation 433T
Dell Drive Array
Dell Powerline System 420DE
Dell Powerline System 420SE
Dell Powerline System 425DE
Dell Powerline System 425SE
Dell Powerline System 433DE
Dell Powerline System 433SE
Dell Powerline System 450DE
Dell Powerline System 450SE
Dell System 325P
Dell System 333P
Dell System 433P
Dell System 433TE
Dell System 486D20
Dell System 486D25
Dell System 486D33
Everex Step 386/25
Everex Step 386/33
Everex Step 386/33
Everex Step 386/33 Tower
Everex Step 486/25
Everex Step 486/33
Everex Step 486/33 12-Slot EISA
Everex Step 486/33 8-Slot EISA

Everex Step 486/33 Cube
Everex Step 486/33 Tower
Everex Step Cube 486/33e
GRiD 325sc
GRiD 386is-16
GRiD 386is-20
GRiD 386is-25
GRiD 386is-33
GRiD 386isx-20
GRiD 386mc
GRiD 386sx-MFP
GRiD 386sx-MFP20
GRiD 486ei-25/SVR
GRiD 486ei-33
GRiD APT/425se
GRiD MFP/420s
Hermes H 220
Hermes H 220 S
Hermes H 260 S
Hermes H 320
Hermes H 335
Hermes H 360
Hermes H 400
Hermes H 400 E
Hermes H 410
Hermes H WALKSTATION 286 V
Hermes H WALKSTATION 386 33
Hermes H WALKSTATION 386 SX
Hermes H WALKSTATION 386 SX
Hermes H WALKSTATION SX 20
HP Vectra 286/12
HP Vectra 386/16N
HP Vectra 386/20N
HP Vectra 386/25N *
HP Vectra 386/25S *
HP Vectra 486/25T
HP Vectra 486/33N *
HP Vectra 486/33T
HP Vectra 486/66N *
HP Vectra 486/66ST *
HP Vectra 486S/20
HP Vectra QS/16S
HP Vectra QS/20
HP Vectra RS/20
HP Vectra RS/25C
IBM PC AT
IBM PS/2 Model 50
IBM PS/2 Model 60
IBM PS/2 Model 70 386
IBM PS/2 Model 80 386
IBM PS/2 Model 90
IBM PS/2 Model 95 XP
IBM PS/2 Model P70
IBM PS/2 Model P75
ICL Alfaskop DS 348
ICL Alfaskop DS 458 Eisa
ICL Alfaskop DT 226
ICL Alfaskop DT 336
ICL Alfaskop DT 336sx
ICL Alfaskop DT 346
ICL Alfaskop DT 346
ICL Alfaskop DT 436sxe
Lucky-GoldStar LG 433W *
MiTAC 4080f
MiTAC 4280g
NCR 3000 Model 3304
NCR 3000 Model 3320
NCR 3000 Model 3340
NCR 3000 Model 3340
NCR 3000 Model 3341
NCR 3000 Model 3345
NCR 3000 Model 3345
NCR 3000 Model 3420
NCR 3000 Model 3445
NCR 3000 Model 3447
NCR EL PC 386
NCR PC925
NEC Powermate 386/25s
NEC Powermate 486/25E
Northgate Elegance 333
Northgate Elegance 425i
Northgate Elegance 433e
Northgate SlimLine 320SX
Olivetti 1 Laptop D33
Olivetti 1 Laptop S20
Olivetti 1 Notebook A12
Olivetti 1 Notebook S20
Olivetti 1 Notebook V16
Olivetti LSX5005
Olivetti LSX5010 *
Olivetti LSX5020 *
Olivetti LSX5020 with PEM *
Olivetti M250e
Olivetti M300
Olivetti M300-01
Olivetti M300-05
Olivetti M300-10
Olivetti M300-25
Olivetti M380-40
Olivetti M380-XP4
Olivetti M380-XP7
Olivetti M380-XP9
Olivetti M400-10
Olivetti M486
Olivetti M486 ESDI
Olivetti P500
Olivetti P750
Olivetti P800

Olivetti PC PRO 290 SP
Olivetti PC PRO 33
Olivetti PC PRO 486/33
Olivetti PC PRO 486SX
Olivetti PC PRO 486SX mt
Olivetti PC PRO SX 16
Olivetti PC PRO SX 20
Olivetti PCS 286
Olivetti PCS 286 S
Olivetti PCS 386 SX
Packard-Bell Model Force 486
Packard-Bell Model PB 300
Packard-Bell Model PB 486-25
Packard-Bell Model PB 486/33
RDI 386/33C
Siemens-Nixdorf PWS M
Tandy 2500SX
Tandy 2500SX/20
Tandy 4016DX
Tandy 4016SX
Tandy 4020LX
Tandy 4020SX
Tandy 4025LX
Tandy 4033LX
Tandy 4820SX/T
Tandy 4833LX/T
Tandy 5000MC
Tatung TCS8900S
Triumph-Adler P35
Triumph-Adler P35 S
Triumph-Adler P45
Triumph-Adler TA DARIO 286
Triumph-Adler TA DARIO 286 S
Triumph-Adler TA DARIO 386 SX
Triumph-Adler TA DARIO 486
Triumph-Adler TA DARIO 486 SX
Triumph-Adler TA DARIO 486 SXE
Triumph-Adler TA DARIO DX/33
Triumph-Adler TA DARIO S/20
Triumph-Adler TA DARIO SX/20
Triumph-Adler TA WALKSTATION 286 V
Triumph-Adler TA WALKSTATION 386 33
Triumph-Adler TA WALKSTATION 386 SX
Triumph-Adler TA WALKSTATION SX 20
Unisys PW2 - 800 386/20
Unisys PW2 - 800 386/25
Unisys PW2 - 800 386/33
Unisys PW2 - 800 486/25
Unisys PW2 Advantage 3163 *(1)
Unisys PW2 Advantage 3206
Unisys PW2 Advantage 3256
Unisys PW2 Advantage 3336
Zenith MastersPort 386SL
Zenith MastersPort 386SX
Zenith SupersPort 486DX
Zenith SupersPort 486SX
Zenith Z-248/12
Zenith Z-286 LP plus
Zenith Z-386/16
Zenith Z-386/20
Zenith Z-386/25Zenith Z-386/25M
Zenith Z-386/SX
Zenith Z-386SX/20
Zenith Z-386/33
Zenith Z-486/25e
Zenith Z-486/25E
Zenith Z-486/33E
Zenith Z-486/33ET *
Zenith Z-486/33ET (European)
Zenith Z-486/ET
Zenith Z-486/SX 20
Zenith Z-LP plus
Zenith Z-LS model 40
Zenith Z.Note 325L Notebook PC *
Zenith Z-SERVER 425SE *
Zenith Z-SERVER 433DE *
Zenith Z-SERVER 450DE *

Displays

Any display 100% compatible with those in the following list:

CGA (color graphics adapter)
EGA (enhanced graphics adapter)
EGA (enhanced graphics adapter) with high-resolution monochrome display
VGA (video graphics array), color and monochrome
IBM 8514/a high-resolution display
IBM MCGA (multicolor graphics array)

Printers and Plotters

Any printer 100% compatible with those in the following list:

9400PS: Agfa-Compugraphic 9400PS v49_3
Dataproducts LZR 1260: Dataproducts LZR 1260 v47_0
Dataproducts LZR 2665: Dataproducts LZR-2665
Epson 24 pins - 136 columns printer: 24-pin 136 Col
Epson 24 pins - 136 columns printer: LQ-1050
Epson 24 pins - 80 columns printer: 24-pin 80 Col
Epson 24 pins - 80 columns printer: LQ-850
Epson 9 pins - 136 columns printer: 9-pin 136 Col
Epson 9 pins - 80 columns printer: 9-pin 80 Col
Epson color 24 pins - 136 columns printer: LQ-2500
Epson Economy 24 pins - 80 columns printer: LQ-500
Epson Economy 24 pins - 80 columns printer: LQ-510
Epson FX Series 9 pins - 136 columns printer: FX-1050
Epson FX Series 9 pins - 136 columns printer: FX-286e
Epson FX Series 9 pins - 80 columns printer: FX-850
Epson LX Series 9 pins - 80 columns printer: LX-800
Epson LX Series 9 pins - 80 columns printer: LX-810
First Epson 9 pins - 80 columns color printer: JX-80
Generic: Generic PostScript Printer
High Performance Epson 9 pins - 136 columns printer: DFX-5000
High Performance Epson color 9 pins - 136 columns printer: EX-1000
High Performance Epson color 9 pins - 80 columns printer: EX-800
High Resolution Epson 24 pins - 110 columns

printer: LQ-950 (N9)
High Resolution Epson 24 pins - 136 columns printer: LQ-1050 (N9)
High Resolution Epson 24 pins - 80 columns printer LQ-850 (N9)
High Resolution Epson color 24 pins - 136 columns printer: LQ-2550
HP 7470A Plotter: HP7470A
HP 7475A Plotter: HP7475A
HP 7550A Plotter: HP7550A
HP 7580A Plotter: HP7580A
HP 7580B Plotter: HP7580B
HP 7585A Plotter: HP7585A
HP 7585B Plotter: HP7585B
HP 7586B Plotter: HP7586B
HP ColorPro: HP7440A
HP DraftMaster I: HP7595A
HP DraftMaster II: HP7596A
HP DraftPro: HP7570A
HP LaserJet 2000: HP LaserJet 2000
HP LaserJet 500 Plus: HP LaserJet 500 Plus
HP LaserJet Classic: HP LaserJet Classic
HP LaserJet IID: HP LaserJet IID
HP LaserJet IIP: HP LaserJet IIP
HP LaserJet Plus: HP LaserJet Plus
HP LaserJet Series II: HP LaserJet Series II
IBM 3816 - 01D
IBM 3816 - 01S
IBM 3852 Jetprinter 2
IBM 4019 LaserPrinter
IBM 4201 Proprinter
IBM 4201 Proprinter II
IBM 4201 Proprinter III
IBM 4202 Proprinter II XL
IBM 4202 Proprinter III XL
IBM 4202 Proprinter XL
IBM 4207 Proprinter X24
IBM 4207 Proprinter X24E
IBM 4208 Proprinter XL24
IBM 4208 Proprinter XL24E
IBM 4224 - 01, 02, E3
IBM 4224 - C2
IBM 5152 Graphics Printer
IBM 5182 Color Printer
IBM 5201 QuietWriter I
IBM 5201 QuietWriter II
IBM 5202 QuietWriter III
IBM 5204 QuickWriter
IBM 5216 Wheelprinter
IBM 6180 Plotter: IBM6180
IBM 6182 Plotter: IBM6182
IBM 6184 Plotter: IBM6184
IBM 6186-1 Plotter: IBM6186-1
IBM 6186-2 Plotter: IBM6186-2

IBM 7371 Plotter: IBM7371
IBM 7372 Plotter: IBM7372
IBM 7374 Plotter: IBM7374
IBM 7375-1 Plotter: IBM7375-1
IBM 7375-2 Plotter: IBM7375-2
IBM LaserPrinter: IBM 4019 v52_1 (17 Fonts)
IBM LaserPrinter: IBM 4019 v52_1 (39 Fonts)
IBM NULL Printer Driver
IBM Personal Page Printer II: IBM 4216-031
v51_4 SheetFeed
IBM Personal Page Printer II: IBM Personal Page
Printer II-30
IBM Personal Page Printer II: IBM Personal Page
Printer II-31
IBM Personal Pageprinter: IBM Personal
Pageprinter
LaserWriter II NT: Apple LaserWriter II NT
LaserWriter II NTX: Apple LaserWriter II NTX
LaserWriter Plus: Apple LaserWriter Plus
LaserWriter Plus: Apple LaserWriter Plus v42_2
LaserWriter: Apple LaserWriter
LCS15: Wang LCS15
LCS15: Wang LCS15 FontPlus
Linotype: Linotronic 100 v38_0
Linotype: Linotronic 100 v42_5
Linotype: Linotronic 200 v47_1
Linotype: Linotronic 200 v49_3
Linotype: Linotronic 300 v47_0
Linotype: Linotronic 300 v47_1
Linotype: Linotronic 300 v49_3
Linotype: Linotronic 500 v49_3
Olivetti LP 5000: Olivetti LP 5000
OmniLaser: TI OmniLaser 2108
OmniLaser: TI Omnilaser 2115
P400PS: Agfa/Compugraphic 400PS
Phaser Card: Phaser Card v1_1
PrintServer 40: Digital LPS PrintServer 40
PS-R4081: AST TurboLaser
QMS ColorScript 100: QMS ColorScript 100
QMS-PS 800+: QMS-PS 800 Plus
QMS-PS 800: QMS-PS 800
QMS-PS 810 : QMS-PS 810
Qume ScripTEN: Qume ScripTEN
ScriptPrinter: Digital LN03R ScriptPrinter
SilentWriter: NEC LC-890
Varityper VT-600: Varityper VT-600

Pointing Devices

*Any mouse 100% compatible with
those in the following list:*

Hewlett-Packard mouse
IBM PS/2 mouse
Logitech mouse

Microsoft Mouse
Mouse systems mouse on Com 1
Mouse systems mouse on Com 2
Olivetti mouse
Olivetti/AT&T keyboard mouse

Keyboards

*Any keyboard 100% compatible with
those in the following list:*

Standard keyboards
Hewlett-Packard keyboards
Olivetti keyboards

Disk Adapters

The following SCSI disk adapters have

been tested:

Adaptec AHA 1515
Adaptec AHA 1520/1522
Adaptec AHA 1640
Adaptec AHA 1740/1744
Adaptec AHA1540/1542
Adaptec AIC-6260
ADIC ISA-1 (AT)
ADIC EISA-1 (EISA)
ADIC MCA-1 (Microchannel)
DPT PM2001/90 & 95
DPT PM2011/9095
DPT PM2011B/90
DPT PM2012A/90 & 95
Future Domain TMC-1660/1680
Future Domain TMC-1680
Future Domain TMC-845/850/860/885
Storage Dimensions SDC-1611,1611B *(2)
Storage Dimensions SDC-3211B
Storage Dimensions SDC-1602, 1602B
Storage Dimensions SDC-3222B
Western Digital WD 7000AX
Western Digital WD7000 Fasst2
Western Digital WD7000EX110/210

Network Adapters

*The following network adapters have
been tested:*

3Com Corporation EtherLink (3C501) *
3Com Corporation EtherLink 16 (3C507) *
3Com Corporation EtherLink II (3C503) *
3Com Corporation EtherLink MC (3C523) *
3Com Corporation EtherLink Plus (3C505-B) *

- 3Com Corporation EtherLink/MC32 (3C527) *
- 3Com Corporation TokenLink (3C603) *
- Accton Technology EtherCoax - 16N *
- AMD AM2100 *
- Amplus Informatica S. A. Amplicard AC 210/AT *
- Amplus Informatica S. A. Amplicard AC 210/XT *
- Cabletron E2010-X *
- Cabletron E2112 *
- Cabletron E3010-X *
- Cabletron E3112-X *
- Cabletron T2015 *
- Cabletron T3015 *
- Compaq 32-bit DualSpeed Token Ring *
- Compex ENET16/U *
- Concord Communications 1215 *
- Concord Communications 1410 *
- DCA DCA 10 megabit 16 bit ISA card *
- DCA DCA 10 megabit fiber optic card *
- DCA DCA 10 Megabit twisted pair *
- DCA IRMATrac Token-Ring/Convertible 16/4 *
- DEC DEC EtherWORKS LC *
- DEC DEC EtherWORKS MC *
- DEC DEC EtherWORKS Turbo *
- DEC DEPCA *
- Dowty PC0114 *
- Dowty PS0114 *
- Eden Sistemas ED586/32 *
- Everex SpeedLink /PC16 (EV2027) *
- Hewlett-Packard Ethertwist EISA LAN Adapter/32 (HP27248) *
- Hewlett-Packard HP Ethertwist 16 TP (HP27247) *
- Hewlett-Packard HP Ethertwist 8 TL (PC27250A) *
- Hewlett-Packard HP Ethertwist 8 TP (HP27245) *
- Hewlett-Packard MC LAN Adapter/16 TP (HP27246) *
- Hewlett-Packard PC LAN Adapter/16+ TL (HP27252A) *
- Hewlett-Packard PC LAN Adapter/16+ TP (HP27247B) *
- Hughes LAN Systems HLS-6130 *
- IBM PC Network Adapter *
- IBM PC Network Adapter II *
- IBM PC Network Adapter II/A *
- IBM PC Network Adapter/A *
- IBM Token Ring *
- IBM Token Ring /A *
- IBM Token Ring II *
- IBM Token Ring 4/16 *
- IBM Token Ring 4/16 A *
- Intel Corp. EtherExpress 16 *
- Intel Corp. EtherExpress 16TP *
- Intel Corp. EtherExpress 32 *
- Intel Corp. Motherboard Lan Module *
- Intel Corp. Token Express MCA 16/4 *
- Intel Corp. TokenExpress EISA 16/4 *
- Intel Corp. TokenExpress ISA 16/4 *
- Madge Networks Smart 16/4 AT RingNode *
- Madge Networks Smart 16/4 EISA RingNode *
- Madge Networks Smart 16/4 MC RingNode *
- Madge Networks Smart 16/4 XT RingNode *
- National Semiconductor Ethernode *16AT *
- National Semiconductor Sonic EISA (DP83932EB) *
- NCR NCR StarCard (8 bit) *
- NCR NCR Token Ring Adapter *
- NCR Systems BV WaveLAN/AT *
- NCR Systems BV WaveLAN/MC *
- Network Peripherals NP-EISA *
- Network Peripherals NPI-ISA/p *
- Network Peripherals NPI-ISA/S *
- Networth, Inc. EtherneXt 16-bit UTP card *
- Nokia Data Ethernet IIe *
- Novell NE1000 *
- Novell NE2000 *
- Novell NE3200 *
- Olicom Olicom 16 bit ISA *
- Proteon P1340 *
- Proteon P1342 *
- Proteon P1346 *
- Proteon P1347 *
- Proteon P1390 *
- Proteon P1392 *
- Proteon P1840 *
- Proteon P1990 *
- PureData PDE9025-32 *
- PureData PDI508+ *
- PureData PDI516+ *
- PureData PDI8023-16 *
- PureData PDI8023-8 *
- PureData PDI90211 *
- PureData PDI9025-16 *
- PureData PDuC8023 *
- PureData PDuC90211 *
- PureData PDuC9025 *
- Racal Interlan NI 5210 *
- Racal Interlan NI 6510 *
- Racal Interlan NI 9210 *
- Racal-Datacom ES3210 *
- Racore Computer Products M8113 *
- Racore Computer Products M8114 *
- Racore Computer Products M8115 *
- RCE France MM031 *
- RCE France MM036 *
- Research Machines, Ltd. Research Machines Ethernet AT-2 *
- Research Machines, Ltd. Research Machines MCA Ethernet *
- Spider Communications SC-100E *

Standard Microsystems Ethernet 3016 Series *	Hitachi CDR-1750s
Standard Microsystems SMC 8003EP *	IBM
Standard Microsystems SMC 8003EPC *	LMSI cm 214
Standard Microsystems SMC 8013EPC *	NEC CDR 73
Standard Microsystems SMC 8013EWC *	Sony cdu-541
Standard Microsystems SMC 8013WC *	Toshiba TXM-3301a1
Standard Microsystems SMC Arcnet 600W *	Toshiba TXM-3201a1
Standard Microsystems SMC ARCNET PC130E (8 bit) *	
Standard Microsystems SMC Arcnet PC550W (16 bit) *	
Thomas Conrad TC4045 *	
Thomas Conrad TC6145 (16 bit ISA) *	
Toshiba ToshibaLAN *	
TRW PC2001 *	
Tulip Computers TNCC-16 CAT *	
Ungermann-Bass Access/MC *	
Ungermann-Bass Access/PC-16 *	
Ungermann-Bass Access/PC-8 *	
Ungermann-Bass NICps/2 *	
Ungermann-Bass NIUpc (PC2030) *	
Ungermann-Bass NIUpc/EOTP (PC4035) *	
Ungermann-Bass NIUps (PC3030) *	
Ungermann-Bass NIUps/EOTP (PC3035) *	
Western Digital 16-bit Token Ring (WD 8015TR) *	
Western Digital 8-bit Token Ring (WD 8005TR) *	
Western Digital EtherCard+ WD8003E *	
Western Digital EtherCard+/A *	

SCSI Disk Drives

The following SCSI disks have been tested:

Fujitsu M2611SA
Maxtor 7040SR
Micropolis Microdisk 340
Micropolis Microdisk 670
Micropolis Microdisk 1340
Quantum Prodrive 40S
Seagate ST1201N
Seagate ST1239A
Seagate ST1239N
Seagate ST4766N
Seagate ST1480N
Storage Dimensions SpeedStor/2 series
Storage Dimensions SpeedStor/2 Erasable Optical

CD-ROM Drives

*The following CD-ROM drives have been tested: *(3)*

Denon Drd-253

Multichannel Communication Boards *The following Communication Boards have been tested:*

DigiBoard DigiCHANNEL PC /4e *
DigiBoard DigiCHANNEL PC/8e *
DigiBoard DigiCHANNEL PC/16e *
DigiBoard DigiCHANNEL MC/8i *
DigiBoard DigiCHANNEL MC/16i *
DigiBoard DigiCHANNEL ISA C/16 *
DigiBoard DigiCHANNEL MC C/16 *
DigiBoard DigiCHANNEL EISA C/16 *

Uninterruptable Power Supplies (UPS) *The following UPS devices have been tested:*

American Power Conversion Back-UPS 400 *
American Power Conversion Back-UPS 450 *
American Power Conversion Back-UPS 600 *
American Power Conversion Back-UPS 900 *
American Power Conversion Back-UPS 1250 *
American Power Conversion Smart-UPS 400 *

American Power Conversion Smart-UPS 600 *
American Power Conversion Smart-UPS 900 *
American Power Conversion Smart-UPS 1250 *
American Power Conversion Smart-UPS 2000 *
Network Security Systems IPSA/A.I. 800 *
Para Systems Inc PM600 *
Superior Electric UPSY61008 *
Superior Electric UPSY61008R *
Tripp Lite BC800LAN *

Notes:

- *(1) Supported only with the Adaptec AHA1542b.
- *(2) The Storage Dimensions driver currently only supports SCSI disks. Please contact Storage Dimensions for updates that enable tape and CD-ROM operation.
- *(3) Not all adapter/CD-ROM combinations are compatible due to restrictions in firmware. Please verify compatibility with your reseller prior to purchase.

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Corporate Technology Team Tech Notes

Part #	Title	Product
098-20914	Memory Allocation for MS LAN Manager Servers	LAN Manager
098-21090	Tuning a MS LAN Manager File Server	LAN Manager
098-31836	LAN 2.1 NetBEUI	LAN Manager
098-31837	LAN 2.1 Multiple Protocols	LAN Manager
098-30193	Using Microsoft SQL Server on a Banyan VINES Network	SQL Server
098-30194	Developing Microsoft Windows-based Applications for Microsoft SQL Server	SQL Server
098-30199	Query Optimization Techniques	SQL Server
098-32078	ODS Application Sourcebook	SQL Server
098-32655	Using Microsoft SQL Server on a Netware Network	SQL Server
098-33163	Implementation Details of the Microsoft LAN Manager TCP/IP Protocol	LAN Manager
098-33165	Interfaces to the Microsoft LAN Manager TCP/IP Protocol	LAN Manager
098-33164	Optimizing the MS LAN Manager TCP/IP Protocol	LAN Manager
098-32660	Connecting to Mainframes with the Microsoft DLC Protocol	LAN Manager

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098-32661	Microsoft Remote Access Server 1.0 Technical Overview	LAN Manager
098-32662	DCA/Microsoft Comm Server 1.1 Installations and Tuning	Comm Server
098-34657	Microsoft LAN Manager and MS-DOS Memory Management	LAN Manager
098-34655	CommServer 1.1 Server Preparation Docs	Comm Server
098-35409	A Comparison of the Microsoft LAN Manager NetBEUI and 3Com NBPLAN Manager Protocols	
098-32659	Developing 32-Bit SQL Server Applications for Microsoft Windows NT SQL Server	
098-34656	Discussion of the ANSI SQL Standard and Microsoft SQL Server	SQL Server
098-36256	Developing 32-Bit Open Data Services Applications for the Microsoft Windows NT Operating System	SQL Server
098-37238	Migrating IBM LAN Server/IBM PC LAN to Microsoft LAN Manager	LAN Manager

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