

NIAKWA DATA MANAGER

MS-DOS/BTRIEVE ADDENDUM



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PREFACE

P.1 NDM MS-DOS/Btrieve Addendum

The Niakwa Data Manager (NDM) allows Niakwa Programming Language applications to use state-of-the-art native ISAM products to store data while retaining full portability. This section describes the organization of the NDM manuals, the required knowledge for using NDM, and the notational conventions used to denote command codes and parameters that may be needed with this manual.

P.1.1 How to Use this Manual

The NDM documentation consists of two manuals, the NDM Programmer's Guide and the NDM MS-DOS/Btrieve Addendum. This addendum provides operating environment and Btrieve-specific information as it relates to the NDM functions and installation. This manual also documents all Btrieve-specific configuration requirements, extended NDM features supported, and NDM limitations under Btrieve.

This should be used with the NDM Programmer's Guide which is intended as a hardware-independent guide for programmers in the correct use of the NDM functions, NDM program development, NPL program conversions, and the NDM Utilities.

This MS-DOS/Btrieve Addendum is organized by chapters.

Chapter 1 discusses the specifics of configuring, installing, and starting NDM under MS-DOS-supported operating environments.

Chapter 2 discusses integrating external routines with the NDM API.

Chapter 3 discusses Btrieve limitations and supported toolbox features as they affect NDM under MS-DOS supported operating systems environments.

Chapter 4 discusses some of the considerations necessary when installing NDM for end-users.

P.1.2 Prerequisite Knowledge

This MS-DOS/Btrieve Addendum assumes that the user has at least a basic knowledge of the computer system in use, the native operating system/environment, and the Niakwa Programming Language. It also assumes that Btrieve is installed and operating correctly. Refer to the appropriate system's manuals for more information regarding specific hardware, operating system/environment, NPL and Btrieve.

P.1.3 Notational Conventions

The NDM Programmer's Guide and MS-DOS/Btrieve Addendum use the following notational conventions.

NOTE: Notes provide information of particular importance.



WARNING--Warnings are conditions that require special care by the user. Disregarding this information could result in a serious problem.

HINT: Hints provide helpful comments pertaining to the use of particular features.

For documentation purposes, examples in this manual use both the number and name of the API functions.

Under NPL Release III, only API function numbers can be used when issuing an NDM call. Under NPL Release IV, the API function number or name can be used (but not both at the same time).

In addition, long variable names used for the API parameters can be used under NPL Release IV only. Standard NPL variable names should be used under NPL Release III.

All alpha parameters used in API function descriptions end in \$, while numeric parameters do not.

For example:

```
'31060 NDM_CREATE_FILE (FILE_NAME$, MODE$, INDEX_NUMBER, KEYDESC_TABLE$, RECORD_LENGTH, ISAM_SPECIFIC$, FILE_HANDLE$, RETURN_CODE)
```

would be coded as follows under Release III:

```
GOSUB' 31060 ("EXAMPLE", M$, I, K$, L, A$, H$, R)
```

under Release III, but could be coded as:

```
GOSUB' NDM_CREATE_FILE ("EXAMPLE", SHARE_MODE$, INDEX_NUM, KEY_TABLE$, REC_LENGTH$, ISAM_CODE$, FILE_HANDLE$, RETURN_CODE)
```

under Release IV.

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CHAPTER 1

INSTALLING NDM

1.1 Overview

This chapter discusses the specifics of configuring, installing and starting NDM under MS-DOS supported operating environments.

Section 1.2 discusses system requirements.

Section 1.3 discusses system files that may need to be modified.

Section 1.4 discusses configuring Btrieve.

Section 1.5 discusses NDM software installation and file locations.

Section 1.6 discusses starting NDM.

1.2 System Requirements

The following table shows the system requirements for NDM under MS-DOS operating environments using Novell's Btrieve.

Hardware	Processor	Operating Environment	Operating System	Btrieve
IBM-compatible PC	8086 or greater	MS-DOS	MS-DOS 3.1 or greater	Btrieve for MS-DOS ver. 5.10a or greater*
IBM AT-compatible PC	80286 or greater	MS-Windows 3.0 or greater (single-user)	MS-DOS 3.1 or greater	Btrieve for MS-Windows ver. 5.10a or greater*
IBM-compatible PC	80386 or greater	Phar Lap 386/DOS-Extender ver. 5.X or greater	MS-DOS 3.1 or greater	Btrieve for MS-DOS ver. 5.10a or greater*
IBM-compatible PC	80286 or greater	Novell NetWare 2.11 or greater	MS-DOS 3.1 or greater	Btrieve and Brequest for Novell NetWare ver. 5.16a or greater*
IBM-compatible PC	8086 or greater	NetBIOS compatible environment (i.e., NetWare Lite, LANtastic, etc.)	MS-DOS 3.1 or greater	Btrieve for MS-DOS ver. 5.10a or greater*

* Niakwa strongly recommends that the latest version of Btrieve always be used.

NOTE: On Novell NetWare platforms, the Btrieve NLM is loaded on the file server. Only the BREQUEST program is required on the workstations. Refer to the Btrieve documentation for details.

The following is a list of the requirements necessary for NDM to function.

NOTE: Developers using NDM for NetBIOS platforms should follow the single-user requirements as shown below.

Memory

NDM for MS-DOS is shipped with libraries that allow the use of NDM with NPL Release III or Release IV under MS-DOS, MS-Windows and the 386/DOS-Extender implementations of NDM (only a Release IV executable is supplied with the 386/DOS-Extender version). Therefore, the possible combinations between the Interpretive and Non-interpretive versions of NPL and different NDM libraries are many. The following information indicates the approximate minimum memory requirements of each required NDM component. Refer to the NPL MS-DOS Supplement and supporting addenda for the specific NPL RunTime requirements.

The memory requirements for NDM for standard system configurations:

MS-DOS

NDM for MS-DOS 73K (size of the NDM quick library file)

MS-Windows

NDM for MS-Windows 75K (size of the NDM DLL file)

386/DOS-Extender

NDM for 386/DOS-
Extender 115K (size of NDM portion of linked RunTime file)

Btrieve or Brequest uses additional memory. Refer to the Btrieve documentation for specific memory requirements.

NOTE: NDM can be configured to allocate additional memory for internal use. Refer to the NDM Programmer's Guide, Chapter 10, 31320 NDM_INITIALIZE for details. In addition, Btrieve can be configured to allocate memory for its use. Refer to the Btrieve documentation for details.

Disk

A hard drive is required. NDM uses approximately 1 MB of hard disk space.

Diskette

One diskette drive must be present for installation.

1.3 System Setup

For proper operation of NDM, modifications must be made to the AUTOEXEC.BAT and CONFIG.SYS files on every system that uses NDM.

NOTE: For information on the CONFIG.SYS and AUTOEXEC.BAT files, refer to the MS-DOS manuals.

1.3.1 CONFIG.SYS

Modify the CONFIG.SYS file according to the specifications set by the appropriate version of Btrieve.

The FILES parameter may require modification. The value to set should be at least equal to the sum of the:

- Number of file handles used internally by NPL (1).
- Number of file handles used internally by NDM (2).
- The maximum number of NDM files to be opened concurrently by the application.
- The maximum number of diskimages or other files to be opened by the application by traditional NPL methods.
- The number of files used by MS-DOS (5).
- The number of files recommended for the use of MS-Windows (30 for MS-DOS, or 70 for Novell NetWare. Consult the manual for the NetBIOS network in use for NetBIOS file requirements).

1.3.2 AUTOEXEC.BAT

Modify the AUTOEXEC.BAT file according to the specifications set by the appropriate version of Btrieve.

NDM Environment Variable

The setting of the NDM environment variable, discussed in Section 1.3.3, should be added to the AUTOEXEC.BAT file so that the statement is executed each time the system is started.

SHARE

NDM allows the same file to be open under multiple file handles by the same user. The NDM Utilities make use of this capability. To prevent a file-sharing error from occurring when in this situation, it is necessary to execute the MS-DOS SHARE program before starting the NDM.

This can be accomplished by adding the following line to the AUTOEXEC.BAT file or executing the statement from an MS-DOS prompt:

```
SHARE
```

NOTE: The DOS SHARE program must be in the root directory for the above statement to work correctly. Users of Novell NetWare systems that do not access data files on the local drives are not required to use the SHARE command.



WARNING -- It is necessary for users on NetBIOS systems to load SHARE whenever NDM files will be accessed from a combined Novell NetWare and NetBIOS network.

NOTE: When executing NDM under MS-Windows on a Novell Netware network, there are several situations in which DOS SHARE should or should not be used. Refer to Section 3.2.2 of the NPL MS-Windows Addendum for details.

1.3.3 NDM Environment Variable

NDM allows the user the freedom to store the NDM software in any subdirectory on the host system's hard drive. This location is then passed to NDM by means of the NDM environment variable. Consequently, the environment variable must be set prior to using NDM.

NOTE: This variable must be set prior to running NDM. It is strongly recommended that it be set in the AUTOEXEC.BAT file to execute automatically.

The NDM environment variable is set by the MS-DOS SET statement. This may be entered at a system prompt or added to the AUTOEXEC.BAT file as shown below:

```
SET NDM =N:\XXXX\
```

where:

N Is the drive designation.

XXXX Is the directory where the NDM files are located.

If no drive is specified, NDM uses the current drive. Since, under MS-DOS, the current drive can be changed (using \$SHELL), Niakwa strongly recommends that the drive be explicitly specified in the NDM environment variable.

HINT: To verify that the NDM environment variable is set, enter SET at a system prompt and review the output for the appropriate set statement.

1.3.4 Novell NetWare Issues

The following section discusses issues specific to Novell NetWare installations.

Login Script File

The Login script file must be modified so that each user using NDM has the proper mappings and search paths to the NDM directory. Refer to the Novell NetWare documentation for more information on the Login Script.

Required Access Privileges

Novell Netware provides a complex security system which allows the System Administrator to grant each user "access privilege" to specific directories or files on the network file system. The NPL RunTime and NDM can be operated under this security system, providing that the users on the network who need access to the RunTime are granted necessary access privileges to the directories indicated in Section 3.2 of the Release IV NPL Novell Netware Addendum and the /NDM directory (or the directory pointed to by the NDM environment variable).

1.4 Btrieve/Brequest Installation/Startup Options

The following section discusses the installation and startup options for Btrieve on the operating environments supported by the MS-DOS implementation of NDM.

Refer to Section 1.4.1 when executing NDM in a single-user MS-DOS or NetBIOS environment.

Refer to Section 1.4.2 when executing NDM under Novell NetWare.

Refer to Section 1.4.3 for NDM under MS-Windows considerations.

1.4.1 Btrieve Installation and Setup Options (MS-DOS and NetBIOS)

Btrieve is assumed to be installed and working properly. However, there are several Btrieve startup and installation options that may affect NDM operation.

For MS-DOS based systems, the start up options for Btrieve should be configured as follows:

Memory Size(/M)

The memory size option defines the total size of Btrieve's data area in kilobytes. This option depends on the page size option (see discussion below) and the user must set this value (in kilobytes) based on use versus performance issues.

Page Size (/P)

This option specifies the maximum page size of any Btrieve file to be accessed by NDM. The NDM Utilities and functions cannot create larger files than the size specified by this option. Any attempt to create larger files results in errors.

NOTE: The page size must be a multiple of 512 bytes, but can be no greater than 4096 bytes.

The page size is greater than or equal to the maximum record length that can be used by a Btrieve file and the NDM functions.

Open Files (/F)

The open files option specifies the maximum number of Btrieve data files an application can have open simultaneously (the maximum number that can be specified is 255). Any attempt by NDM applications to open a number of Btrieve files greater than the number specified by the open files option results in errors.

Transaction Filename(/T)

The transaction filename specifies a location for Btrieve to store the transaction control file. This option must be specified if the application uses the NDM transaction processing features. The filename may include a drive name and directory specification.

Files in a Transaction (/N)

The files in a transaction option set the maximum number of files that can be opened and accessed within a transaction. Valid settings range from 1 to 18, inclusive. If the NDM transaction feature is used, this option and the transaction filename option must be set.

Pre-Image File Drive(/I) and Buffer Size(/B)

The pre-image file drive and buffer size are two configuration options that direct the automatic data recovery that uses the pre-imaging method (this method is totally independent of NDM functionality). The pre-image files are used to implement the transaction feature of NDM. When using the NDM transaction feature, the pre-image files require a larger amount of disk space. The more update, delete, or insert operations that are performed during a single NDM transaction, the larger the page size and pre-image file becomes.

NOTE: The pre-image file drive option directs the pre-image files to a drive other than the drive where the Btrieve files are stored. If the drive specified is a RAM disk, the disk I/O normally required for pre-imaging is eliminated, but the data will not be automatically recovered after a system failure.

The pre-image buffer size option specifies the total amount of memory Btrieve uses for pre-image buffers in kilobytes.

NOTE: The first time a file is opened (even if a file is created using the NDM), Btrieve creates a temporary pre-image file with the same name as the file to be protected, but with a filename extension of .PRE.

Override Critical Error(/O)

The override critical error option controls the way Btrieve responds to DOS-critical errors, such as "Drive Not Ready".

NOTE: This option does not apply to the single-user MS-Windows version of NDM.

If this option is specified and a DOS-critical error occurs during a Btrieve disk operation, a native Btrieve error code is returned to the NDM application (usually a code 2, I/O error, or code 12, file not found). With proper handling, the NDM application is continued. This is the recommended setting.

If this option is not specified and a DOS-critical error occurs, Btrieve routes the error to the standard DOS-critical error handler which returns a DOS error message to the screen. The NDM application is then interrupted to display the DOS error message.

Multiple Locks (/L)

The multiple locks option has no impact on the NDM application used in an MS-DOS environment.

Expanded Memory(/E)

The expanded memory option allows the user to decide if Btrieve is to use expanded memory for its data buffers. If this option is set, Btrieve does not use expanded memory. Btrieve checks for the presence of expanded memory when it loads and uses the base memory if no expanded memory is present.

The decision whether to use expanded memory requires careful consideration for systems using the NPL RunTimes supporting the XMS or extended memory use.

Index Compaction (/C)

The index compaction option directs Btrieve to perform index compaction. This option should be set by the user considering the space savings versus performance of the NDM insert/delete records operations. Aside from performance issues, this option is transparent to NDM functionality.

Compression Buffer Size(/U)

The compression buffer size option is used to allocate the length of the compression buffer used for data compression. NDM does not create data files that allow for data compression, but the NDM read and write functions can access compressed Btrieve data files created independently of NDM. If the NDM application does not use compressed files, then this option should be omitted.

Activate Logging (/A)

This value has no impact on the NDM application.

For more details on the use of the above options, refer to the Btrieve for DOS Installation and Operation Manual, Chapter 2, *Installation* or to the Btrieve Programmer's Manual, Chapter 3, *Designing the Database*.

1.4.2 Btrieve Installation and Setup Options (Novell NetWare)

For Novell Netware-based systems, Btrieve's VAP (Novell NetWare 2.X) or Btrieve's NLM (Novell NetWare 3.X or 4.X) must be set up and running properly on the file server. Refer to the Novell Btrieve documentation for information on installing and configuring the Btrieve VAP or NLM.

Configuring Btrieve on a Novell NetWare System

Btrieve provides a setup utility that is included with the Btrieve software for Novell NetWare that allows the developers to modify Btrieve's configuration options. The BSETUP utility is used to modify these options from the default settings.

NOTE: Refer to the Btrieve documentation for the exact format and name to execute this utility.

Number of Open Files

This value tells NetWare how many unique Btrieve files can be opened on the file server. If this value is set too low, error messages occur during the NDM API function call, 31340 NDM_OPEN_FILE.

Number of Handles

This value tells NetWare how many file handles Btrieve allows the file server to use simultaneously. If this value is set too low, error messages occur during the NDM API function call, 31340 NDM_OPEN_FILE.

Number of Locks

This value tells NetWare how many records network-wide can be locked at one time. NDM allows one record per file handle to be locked.

Number of Transactions

This value tells NetWare how many workstations can have concurrent active transactions at the file server. NDM requires that this value be equal to or greater than the number of workstations that need to use the NDM API transaction function calls.

Number of Files Per Transaction (Btrieve 5.X only)

This value tells NetWare how many files can be opened and accessed within the same transaction. This should be set as required by the application.

Largest Compressed Record Size

This should be set as required by the application.

Largest Record Size

This value tells NetWare how large a record can be. This should be set as required by the application.

Largest Page Size

This must be set equal to the record length plus 6 for the longest fixed length record accessed by the application.

Number of Sessions

This value specifies the maximum number of workstations that can access Btrieve at one time. This value needs to be equal to or greater than the number of workstations that run NDM.

Console Refresh Count (Btrieve 5.X only)

This value has no impact on the NDM application.

Cache Allocation (Btrieve 6.X only)

This option specifies the size of the cache (in kilobytes) that Btrieve allocates. This option helps achieve better application performance. No NDM parameters need to be specified or modified to use this option.

Perform Index Balancing (Btrieve 6.X only)

This option helps increase application performance when an index page becomes full. This option helps achieve better application performance. No NDM parameters need to be specified or modified to use this option.

Create files in Pre-version 6.X Format (Btrieve 6.X only)

If an NDM application is to be installed on a system using a version of Btrieve prior to version 6.X, but the application was created with Btrieve 6.X, this option should be used to create files in the pre-6.X format.

Create Files as Transactional

This value has no impact on the NDM application.

Logging of Selected Files

This value has no impact on the NDM application.

Configure BSTART.NCF to Load BROUTER

This value has no impact on the NDM application.

BREQUEST Startup Options

The following are BREQUEST startup options:

Data Message Length (/D)

This must be set equal to the maximum record length for any file accessed by the application.

NOTE: The options below apply to Btrieve 5.X only. Btrieve 6.X ignores the /R and /S options.

Mapped Drives (/R)

The mapped drives option allows the user to specify the maximum number of mapped drives the workstation can access. If the NDM application must access more than the default, then this option needs to be used.

Number of File Servers (/S)

This must be set to the number of file servers to be used.

For more details on the use of the above options, refer to the Btrieve for Novell Installation and Operation Manual, Chapter 2, *Installation* or to the Btrieve Programmer's Manual, Chapter 3, *Designing the Database*.

1.4.3 Btrieve Installation and Setup Options (MS-Windows)

The following are the Btrieve for MS-Windows setup requirements for MS-DOS, NetBIOS and Novell NetWare systems.

Btrieve for MS-Windows on a MS-DOS or NetBIOS System

The following steps are required to configure Btrieve when executing NDM on a stand-alone MS-Windows/MS-DOS/NetBIOS system.

1. Copy the WBTRCALL.DLL (MS-Windows Requester for DOS) into the MS-Windows sub-directory or a directory that can be located by MS-Windows.
2. Add the following options to the WIN.INI MS-Windows file.

```
[btrieve]
options=/r:25 /:1024
```

3. DOS SHARE.EXE must be loaded before starting NDM.

4. Add the following to the MS-Windows SYSTEM.INI file under [386Enh]

```
UniqueDOSPSP=true
```

Btrieve for a Novell NetWare Network

The following steps are required to configure Btrieve when executing NDM on MS-Windows/Novell NetWare network.

1. Copy the following files to the Novell NetWare file server.

WBTRCALL.DLL	Windows Btrieve requester. This must be present on the path of each workstation so Windows can find it. The Windows subdirectory or F:/PUBLIC are suggested locations for this.
BTRIEVE.NLM	Server-based Btrieve record manager which runs on the server.
BSPXCOM.NLM	Communications program between server and workstations.
BROUTER.NLM	Btrieve message handler required for remote server communications (this is only necessary when remote communications are to take place).

NOTE: To execute both the local and requester (Novell NetWare version) versions of Btrieve, rename the local version of WBTRCALL.DLL to WBTRLOCL.DLL. Refer to the Btrieve for MS-Windows manual for details.

2. The following files should be located on the workstation:

BREQUEST.EXE	DOS requester--this should be initialized before starting Windows.
--------------	--------------------------------------------------------------------

3. The following parameters should be added to the Windows WIN.INI file:

```
[brequestDPMI]
datalength=4096
local=no
chkparms=no
tasks=10
```

Any other options for Btrieve for Windows should also be added to the WIN.INI Windows file. For example:

```
[btrieve]
options=/r:25 /:1024
```

If the application is to access local as well as remote files, WBTRCALL.DLL should be copied to WBTRLOCL.DLL and placed on the path when using versions of Btrieve 5.0. In addition, the local parameter in the WIN.INI file should be changed to "yes".

NOTE: Btrieve 6.0 uses the Windows conversion utility WNDBCNTV.EXE to convert the WBTRCALL.DLL to WBTRLOCL.DLL.

The client version of WBTRCALL.DLL should not be in the path. If Btrieve for Windows locates this file before the server version, it attempts to use it for accessing the files located on the server and an "Access Method not active" error message is generated.

1.5 NDM Development Software Installation

This section discusses the contents and installation of the NDM Development Software on MS-DOS supported operating platforms. The NDM Development Software contains the software necessary to develop NDM applications, as well as the software necessary to install NDM applications at end-user sites (refer to Chapter 4 for details on the software necessary at an end-user site).

NOTE: NDM is sold on a per-programmer and per-platform basis. Developers must be licensed for an NDM Pak on a specific platform before they can distribute NDM.

1.5.1 Diskette Contents

The NDM Development Package diskettes contain the following files:

NDMUTIL.BAT	Program to start the NDM Utilities.
NDMUTIL.BS2	The NDM Utilities diskimage.
CUSTCAT.DAT	Catalog file for the sample program.

CUSTDD.DAT	Data description file for the sample program.
CUSTEXAM.DAT	Data file for the simple example programs.
CUSTKD.DAT	Key description file for the sample program.
CUSTREL.DAT	Relation file for the sample program.
NDMCAT.DAT	Catalog file.
NDMCATD.DAT	Data description file for the catalog file.
NDMCATK.DAT	Key description file for the catalog file.
NDMDDDD.DAT	Data description file for data description files.
NDMDDKD.DAT	Key description file for data description files.
NDMERR.DAT	Error message file.
NDMERRD.DAT	Data description file for the error message file.
NDMERRK.DAT	Key description file for the error message file.
NDMFTF.DAT	Field type file.
NDMFTFD.DAT	Data description file for the field type file.
NDMFTFK.DAT	Key description file for the field type file.
NDMKDDD.DAT	Data description file for key description files.
NDMKDKD.DAT	Key description file for key description files.
NDMREL.DAT	Relation file.
NDMRELD.DAT	Data description file for the relation file.
NDMRELK.DAT	Key description file for the relation file.

NDMTRAN.DAT	Translation file.
NDMTRAND.DAT	Data description file for the translation file.
NDMTRANK.DAT	Key description file for the translation file.
NDM.HLP	NDM help file. Contains descriptions of the NDM function calls.
NDM.IDX	Index for NDM.HELP
EX1NDM.OBJ	Simple example program number 1.
EX2NDM.OBJ	Simple example program number 2.
NDMUTIL.OBJ	Boot program used when starting the NDM Utilities.
TESTCUST.OBJ	Boot program for the sample program.

MS-DOS Specific Files

NDMBTRV.QLB NDM external library for MS-DOS.

MS-Windows Specific Files

NDMBTRV.DLL NDM external library for MS-Windows.

386/DOS-Extender Specific Files

RTINDM.EXE
(Release IV) Interpretive Release IV NPL RunTime with NDM routines linked into RunTime.

RTPNDM.EXE
(Release IV) Non-interpretive Release IV NPL RunTime with NDM routines linked into RunTime.

NOTE: The quick library technique for loading external routines can not be supported under the 386/DOS-Extender implementation of NPL. As a result, a linked version of NPL and NDM is necessary to execute NDM.

A linked version of NPL Release IV and NDM 1.2 libraries (RTINDM.EXE and RTPNDM.EXE) is provided as part of the NDM Pak files for NDM. If Release III of NPL is being used, it is necessary to link the NDM libraries to the NPL Release III RunTime to create the executables (RTINDM.EXE and RTPNDM.EXE). Refer to Section 2.4 for details.

1.5.2 Installing the NDM Development Package

To install the NDM Development Package, follow the steps shown below:

NOTE: These instructions assume that **A:** is the name of the diskette drive, **C:** is the destination hard drive, and **NDM** is the target directory. If the designation is different on the system being used, be sure to use the proper drive and directory designation instead.

1. Create the directory where the NDM files are to reside on the hard drive.

```
MD C:\NDM
```

2. Insert the NDM diskette labeled Disk 1 of X into diskette drive A and enter:

```
COPY A:\NDM\*.* C:\NDM
```

This copies the NDM software to the specified directory on the hard drive.

3. Insert the next NDM diskette in the sequence into diskette drive A and enter:

```
COPY A:\NDM\*.* C:\NDM
```

This copies the NDM software to the specified directory on the hard drive. Repeat step 3 until all NDM diskettes have been loaded.

NOTE: For information on installing the NDM BESDK routines, refer to Chapter 2.

The NDM Development Package files are now copied to the system's hard drive.

1.6 Configuring and Starting NDM

The following sections discuss the configuration and starting of NDM on the operating environment supported by the MS-DOS implementation of NDM.

Refer to Section 1.6.1 for configuring and starting the MS-DOS implementation of NDM.

Refer to Section 1.6.2 for configuring and starting the MS-Windows implementation of NDM.

Refer to Section 1.6.3 for configuring and starting the 386/DOS-Extender implementation of NDM.

NOTE: Refer to Section 1.6.1 when using the NetBIOS implementation of NDM under MS-DOS and Section 1.6.2 when using the NetBIOS implementation of NDM under MS-Windows.

1.6.1 NDM under Standard MS-DOS

Before NDM can be executed, Btrieve, MS-DOS and NPL must be fully operational on the host system or file server and the NDM environment variable must be set to point to the directory where the NDM files are located (refer to Section 1.3.3).

The general form for starting the standard NDM from a DOS prompt is:

```
RTI /XNDMBTRV <BOOTNAME>  
or  
RTP /XNDMBTRV <BOOTNAME>
```

NOTE: The /X parameter is used in the above statements to specify that the NDM external library (NDMBTRV.QLB) is to be loaded.

These statements assume the NDMBTRV library is in the current directory. If it is not, a full path name must be specified. For example, if the NDMBTRV quick library is located in the \NDM directory, the following statement should be used.

```
RTI /X\NDM\NDMBTRV <BOOTNAME>
```

Other startup options may also be specified. For example, if the /D option is to be used, the startup statement is:

```
RTI /XNDMBTRV /D=20 <BOOTNAME>
```

1.6.2 NDM under MS-Windows

Before NDM can be executed under MS-Windows, Btrieve for Windows, NPL, and MS-Windows must be fully operational on the host system or file server and the NDM environment variable must be set to point to the directory where the NDM files are located (refer to Section 1.3.3).

NOTE: Refer to the Section 3.2.2 of the NPL MS-Windows Addenda for details on using the SHARE command with MS-Windows and Novell NetWare.

Setting the NDM Task Icon

The steps below describe adding an NDM RunTime task to a program group window of the Program Manager under MS-Windows.

1. Select the program group to which the NDM program icon is being added.. The program group must be created if it does not exist (refer to the MS-Windows documentation on creating program groups).
2. From the menu bar, select the File Menu.
3. Select the Program Item from the New Program Object dialog box.
4. Select OK or press Enter. The Program Item Properties dialog box then displays.
5. Enter the description for the title and the command line to be used in the dialog box displayed. For example, to setup a task to load NDM and the NDM Utilities from drive C:, enter the following in the dialog box provided:

Description:	NDM for Windows
Command Line:	RTIWIN.EXE /XC:\NDM\NDMBTRV C:\NDM\NDMUTIL OR RTPWIN.EXE /XC:\NDM\NDMBTRV C:\NDM\NDMUTIL
Working Directory:	C:\NDM
Shortcut Key:	No entry is required.

NOTE: The Working Directory option only appears under MS-Windows 3.1 or later, and the full path is not necessary if this option is used and the DOS path and NDM environment variables are set correctly. Refer to Section 3.3.1 of the Release IV NPL MS-Windows Addenda for details.

The Release IV implementation of NPL for MS-Windows allows multiple external libraries (DLLs) to be loaded when starting the NPL MS-Windows RunTime. Refer to Chapter 8 of the Release IV NPL MS-Windows Addendum for details.

In addition, Release IV allows external libraries to be specified in the RTIWIN.INI file as an alternative to specifying them on the command line. Refer to Section 3.4.4 of the NPL Release IV MS-Windows Addendum.

- The /X command line parameter is used to load the external NDM library. Any other command line parameters needed should be added to the command line. For example, to create an icon to automatically load the NDM Utilities and also allow for 20 device table entries, the Command Line text box should be set to:

```
RTIWIN.EXE /D=20 /XC:\NDM\NDMBTRV C:\NDM\NDMUTIL
```

- MS-Windows automatically selects the default RunTime icon unless the operator uses the Change icon option. Refer to the MS-Windows documentation for more information on selecting different icons.
- Select OK to create the program icon. The new icon appears in the MS-Windows program group selected in Step 1 above.

Starting the NDM RunTime under MS-Windows

NDM Runtime can be started from the MS-Windows Program Manager or from a command line using the MS-Windows Run Program feature.

To start the MS-Windows RunTime from the MS-Windows Program Manager, follow these steps:

1. Load the MS-Windows Program Manager if it is not currently displayed. The Main Group icons or the window that contains the RunTime icon should be displayed.
2. Select the NDM RunTime icon to be run by double-clicking on the desired program icon or by highlighting it and pressing Enter. Refer to Section 1.6.2 for information on creating and installing the RunTime icon.
3. The NPL MS-Windows RunTime and the NDM DLL library are loaded into memory and the application boot program that was specified in the task command line is executed.

The MS-Windows NDM can also be started from the File Run command in the Program Manager. To start the NPL MS-Windows RunTime and NDM by using this option, follow the steps shown below:

1. Choose the File Run command from the Program Manager's File Menu.
2. In the Command Line box, enter the appropriate command line to start NPL and NDM. For example, to load the NDM Utilities, enter:

```
RTIWIN.EXE /XC:\NDM\NDMBTRV C:\NDM\NDMUTIL
```

NOTE: The /X parameter is used in the above statements to specify that the NDM external library (NDMBTRV.DLL) is to be loaded.

3. Select OK or press Enter. The NPL RunTime and NDM then loads and executes the boot program specified in step 2.

1.6.3 386/DOS-Extender NDM

Before NDM can be executed, Btrieve, MS-DOS and NPL must be fully operational on the host system or file server and the NDM environment variable must be set to point to the directory where the NDM files are located (refer to Section 1.3.3).

NOTE: The quick library technique for loading external routines can not be supported under the 386/DOS-Extender implementation of NPL. As a result, a linked version of NPL and NDM is necessary to execute NDM.

A linked version of NPL Release IV and NDM 1.2 libraries (RTINDM.EXE and RTPNDM.EXE) is provided as part of the NDM Pak files for MS-DOS (refer to Section 1.5 for details). When using NPL Release III it is necessary to link the NDM libraries to the Release III NPL RunTime to create the executables (RTINDM.EXE and RTPNDM.EXE). Refer to Section 2.4 for details.



WARNING -- Use of the Release IV linked NPL and NDM requires a Release IV NPL Gold Key to be properly licensed, installed and operating on the host system.

The general form for starting the 386/DOS-Extender implementation of NDM from an MS-DOS prompt is:

```
RTINDM <BOOTNAME>  
or  
RTPNDM <BOOTNAME>
```

Startup options may also be specified. For example, if the /D option is to be used, the startup statement is:

```
RTINDM /D = 20 <BOOTNAME>
```



CHAPTER 2

INTEGRATING EXTERNAL ROUTINES

2.1 Overview

The NDM BESDK diskettes supply the necessary object files, source code and example MAKE procedures to allow developers to integrate their own external routines with NDM for the MS-DOS, MS-Windows, or the 386/DOS-Extender implementations of NDM (three BESDK diskettes are provided).

Section 2.2 discusses the NDM MS-DOS BESDK.

Section 2.3 discusses the NDM MS-Windows BESDK.

Section 2.4 discusses the NDM 386/DOS-Extender BESDK.

2.2 NDM MS-DOS BESDK

The standard MS-DOS version of the NDM uses the quick library mechanism of the Microsoft Linker, which allows the standard MS-DOS implementation NPL to load a specified set of routines after the NPL starts. The following sections discuss creating and linking external routines for use with the standard MS-DOS RunTime's quick libraries (QLB's).

2.2.1 Contents of the Standard NDM MS-DOS BESDK

The standard NDM BESDK diskette contains two directories, \NDM and \NDMEXAM.

The \NDM directory contains the files that, when linked, create the NDM quick library. This directory contains the following files:

MAKEQLB.BAT	Batch file to make the library.
RTP_EXT.C	RTPEXT source code.
RTP_MAIN.C	Mainline.
NDMBTRV.LIB	NDM routines.
NDMBTRV.LNK	Response file for the linker.

The \NDMEXAM directory contains the same files merged with the example external subroutine from the NPL BESDK package, plus the files necessary to compile and link the example. Refer to Chapter 11 of the NPL MS-DOS Supplement for information on the NPL external calls.

The following files are found in the \NDMEXAM directory:

MAKEQLB.BAT	Batch file to make the merged library.
RTP_EXT.C	Merged RTPEXT routine.
RTP_MAIN.C	Merged mainline.

NDMBTRV.LNK Response file for the linker.

Once the NDM MS-DOS BESDK is properly installed, the user should be able to make the example merged library by selecting the NDMEXAM directory and entering:

```
MAKEQLB
```

2.2.2 Installing the NDM MS-DOS BESDK

The NDM and NDMEXAM directories should be installed at the same level as the DOSCEXAM directory of the NPL BESDK directory. The MAKEDLL.BAT and NDM.LNK files assume that this is where the files are located. If these directories are moved to another location, these files must be modified for compiling and linking to succeed.

In the following example, the DOSCEXAM directory of the NPL BESDK is assumed to be in the C:\BASIC2C directory (the full path name of this directory is C:\BASIC2C\DOSCEXAM). It is also assumed that the NDM MS-DOS BESDK disk is in drive A: on the host system. If this is not the case, substitute the correct names as appropriate.

Follow the steps shown below to install the NDM MS-DOS BESDK.

1. Create the NDM MS-DOS BESDK directory by entering:

```
MD C:\BASIC2C\NDM
```

2. Insert the NDM MS-DOS BESDK diskette into drive A and copy the files from the A:\NDM directory to the hard drive by entering:

```
COPY A:\NDM\*.* C:\BASIC2C\NDM
```

3. Create the NDMEXAM directory on the hard drive by entering:

```
MD C:\BASIC2C\NDMEXAM
```

4. Copy the files from the A:\NDMEXAM directory to the directory on the hard drive by entering:

```
COPY A:\NDMEXAM\*.* C:\BASIC2C\NDMEXAM
```

NOTE: It is not necessary to create the above directories in the \BASIC2C directory. It is only necessary to create the BESDK directories on the same level as the DOSCEXAM directory from the NDM MS-DOS BESDK. Refer to the Chapter 11 NPL MS-DOS Supplement for more information on the NPL MS-DOS BESDK.

2.2.3 Merging The External Libraries

To merge two external libraries follow these steps:

1. Copy the files in the NDM MS-DOS BESDK directory to the directory in which the merged library is to be created.
2. Modify the RTP_EXT.C file as follows:
 - Add the C declarations of the other library's routines at the start of the file before the C declarations of the NDM routines.
 - Add the NPL definitions for the other library's routines to the beginning of the switch statement. The rtpdef_next_number field of the last definition that is added must contain the DEFFN' number of the first NDM DEFFN' (31010).
 - Modify the rtpdef_next_number field in the default section of the switch statement to be the lowest DEFFN' number of the NPL definitions being added.

For an example of these changes review the RTP_EXT.C file in the NDMEXAM directory.

3. Modify the RTP_MAIN.C file as follows:
 - Add the initialization and termination routines for the other library to the start of the file.
 - Add a call to the other initialization routine immediately after the call to ndms_init().
 - Add a call to the other termination routine immediately before the call to ndms_done().

For an example of these changes review the RTPMAIN.C file in the NDMEXAM directory.

4. Modify the MAKEQLB.BAT file by adding the statements necessary to compile the file(s) containing the other external subroutines.
5. Modify the NDMBTRV.LNK file by adding the names of the object files that will be produced by compiling the other external subroutines. These names should be added after the second line of the file (each name on a separate line followed by a plus (+)).
6. Run the MAKEQLB.BAT file to compile the necessary files and link them together to create the NDM.QLB file containing the merged external libraries.

NOTE: The NPL external routine definitions in RTP_EXT.C are actually calls to a routine (in the same file) called set_sub(). The parameters to this routine are the values to be placed into the rtpdef structure. The set_sub() routine copies them into this structure. This routine is used to make the code size of the external library slightly smaller than if this copying is repeated for each case within the switch statement.

2.2.4 Using Non-C External Routines

If the external routine definitions are written in Pascal or assembly language it is necessary to do one of the following.

1. Convert these routines to C.
2. Convert the RTP_EXT.C and RTP_MAIN.C to the other language.

This should be a simple line-by-line translation. However, depending on the other language and compiler, it may be necessary to put underscores ("_") at the beginning of each routine name.

2.2.5 Using the Merged Library

The NDMBTRV.QLB file produced by the above steps contains the user external routines and the NDM API routines.

To install this on any system, copy the NDMBTRV.QLB file to the NDM directory of a system where the NDM software has been properly installed.

HINT: To avoid name confusion, rename NDMBTRV.QLB file to the some other name.

Regardless of the name used, the merged library automatically uses the serial number and security information of the standard NDM RunTime installed on the system.

2.3 The NDM MS-Windows BESDK

NDM for Windows is provided as a pre-compiled, pre-linked DLL file. When NPL is executed, the name of this library must be specified on the command line. Refer to Section 1.6 details on starting NDM.

For NPL Release III, if an application must use other external routines with NDM, it is necessary to merge these external libraries with the NDM into one library (only one external library can be used when starting the NPL).

NOTE: The Release IV version of NPL for MS-Windows allows for the loading of multiple external libraries (DLLs) when starting the NPL RunTime for MS-Windows. When using Release IV, it is not necessary to follow the steps below to create a merged external routine when using other external routines besides NDM. Refer to Chapter 8 of the NPL MS-Windows Supplement for details.

The NDM MS-Windows BESDK diskettes supply the necessary object files, source code and example MAKE procedures to allow developers to integrate their own external routines with NDM for MS-Windows.

2.3.1 Contents of NDM MS-Windows BESDK

The NDM MS-Windows BESDK diskette contains two directories, \NDM and \NDMEXAM.

The \NDM directory contains the files that, when linked, create the NDM dynamic link library. This directory contains the following files:

MAKEDLL.BAT	Batch file to make the library.
LIBMAIN.C	Initialization and cleanup library.
RTP_EXT.C	RTPEXT source code.

RTP_MAIN.C	Mainline.
NDMBTRVW.DEF	Used by the linker to make NDMBTRVW.DLL.
NDMBTRVW.LIB	NDM routines.
NDMBTRVW.LNK	Response file for the linker.

The \NDMEXAM directory contains the same files merged with the example external subroutine from the NPL BESDK package, plus the files necessary to compile and link the example. Refer to Chapter 10 of the NPL MS-DOS Supplement and Chapter 8 of the NPL MS-Windows Addendum for information on the NPL external call feature.

The following files are found in the \NDMEXAM directory:

MAKEDLL.BAT	Batch file to make the merged library.
LIBMAIN.C	Initialization and clean up library.
RTP_EXT.C	Merged RTPEXT routine.
RTP_MAIN.C	Merged mainline.
NDMBTRVW.DEF	Used by the linker to make NDMBTRVW.DLL.
NDMBTRVW.LNK	Response file for the linker.

Once the NDM MS-Windows BESDK is properly installed, the user should be able to make the example merged library by selecting the NDMEXAM directory and typing:

```
MAKEDLL
```

2.3.2 Installing NDM MS-Windows BESDK

The NDM MS-Windows BESDK requires the use of the Microsoft Windows Software Development Kit. The MAKEDLL.BAT file assumes the use of the Microsoft C compiler. Refer to the documentation of the compiler in use for the necessary switches to create dynamic link libraries (.DLL's) if using any other compiler.

The NDM and NDMEXAM directories should be installed at the same level as the DOSCEXAM directory of the NPL BESDK directory. The MAKEDLL.BAT and NDMBTRVW.LNK files assume that this is where the files are located. If these directories are moved to another location, these files must be modified for compiling and linking to succeed.

In the following example, the DOSCEXAM directory of the NPL BESDK is assumed to be in the C:\BASIC2C directory (the full path name of this directory is C:\BASIC2C\DOSCEXAM). It is also assumed that the NDM BESDK disk is in drive A: on the PC. If this is not the case, substitute the correct names for your system.

Follow the steps shown below to install the NDM MS-Windows BESDK.

1. Create the NDM MS-Windows BESDK directory by entering:

```
MD C:\BASIC2C\NDM
```

2. Insert the NDM BESDK diskette into drive A and copy the files from the A:\NDM directory to the hard drive by entering:

```
COPY A:\NDM\*.* C:\BASIC2C\NDM
```

3. Create the NDMEXAM directory on the hard drive by entering:

```
MD C:\BASIC2C\NDMEXAM
```

4. Copy the files from the A:\NDMEXAM directory to the directory on the hard drive by entering:

```
COPY A:\NDMEXAM\*.* C:\BASIC2C\NDMEXAM
```

NOTE: It is not necessary to create the above directories in the \BASIC2C directory. It is only necessary to create the BESDK directories on the same level as the DOSCEXAM directory from the MS-DOS BESDK. Refer to the NPL BESDK documentation.

2.3.3 Merging the External Libraries

To merge two external libraries, follow these steps:

1. Copy the files in the NDM MS-Windows BESDK directory to the directory in which the merged library is to be created.
2. Modify the RTP_EXT.C file as follows:

- Add the C declarations of the other library's routines at the start of the file before the C declarations of the NDM routines.
- Add the NPL definitions for the other library's routines to the beginning of the switch statement. The `rtpdef_next_number` field of the last definition that is added must contain the DEFFN' number of the first NDM DEFFN' (31010).
- Modify the `rtpdef_next_number` field in the

default section of the switch statement to be the lowest DEFFN' number of the NPL definitions being added. For an example of these changes, review the `RTP_EXT.C` file in the `NDMEXAM` directory.

3. Modify the `RTP_MAIN.C` file as follows:

- Add the initialization and termination routines for the other library to the start of the file.
- Add a call to the other initialization routine immediately after the call to `ndms_init()`.
- Add a call to the other termination routine immediately before the call to `ndms_done()`.

For an example of these changes, review the `RTPMAIN.C` file in the `NDMEXAM` directory.

4. Modify the `MAKEDLL.BAT` file by adding the statements necessary to compile the file(s) containing the other external subroutines.
5. Modify the `NDMBTRVW.LNK` file by adding the names of the object files that will be produced by compiling the other external subroutines. These names should be added after the second line of the file (each name on a separate line followed by a plus (+)).
6. Run the `MAKEDLL.BAT` file to compile the necessary files and link them together to create the `NDMBTRV.DLL` file containing the merged external libraries.

NOTE: The NPL external routine definitions in RTP_EXT.C are actually calls to a routine (in the same file) called set_sub(). The parameters to this routine are the values to be placed into the rtpdef structure. The set_sub() routine copies them into this structure. This routine is used to make the code size of the external library slightly smaller than if this copying is repeated for each case within the switch statement.

2.3.4 Using Non-C External Routines

If the other external routine definitions are written in Pascal or assembly language, it is necessary to do one of the following.

1. Convert these routines to C.
2. Convert the RTP_EXT.C and RTP_MAIN.C to the other language.

This should be a simple line-by-line translation. However, depending on the other language and compiler, it may be necessary to put underscores ("_") at the beginning of each routine name.

2.3.5 Using the Merged Library

The NDMBTRV.DLL file produced by the above steps contains the user external routines and the NDM API routines.

To install this on any system, simply copy this NDMBTRV.DLL file to the NDM directory of a system where the NDM RunTime has been properly installed.

HINT: To avoid name confusion, rename the NDMBTRV.DLL file to some other name.

NOTE: A standard NPL RunTime must be properly licensed and installed on every system where the merged or developer's library is to be used.

2.4 The 386/DOS-Extender BESDK

The NDM 386/DOS-Extender BESDK diskettes supply the necessary object files, source code and example make procedures to allow developers to link the Phar Lap 386/DOS-Extender version of NDM to the NPL 386/DOS-Extender RunTime files (RTI386.EXE and RTP386.EXE) and create the necessary executables (RTINDM.EXE and RTPNDM.EXE). The NDM 386/DOS-Extender BESDK is also used to integrate developers own external routines with the NPL 386/DOS-Extender RunTime once it has been linked to NDM to create the RTINDM.EXE and RTPNDM.EXE executables.

For the purpose of definition, RTI386.EXE and RTP386.EXE refer to the NPL executables, RTINDM.EXE and RTPNDM.EXE refer to the combined NPL 386/DOS-Extender RunTime and NDM, and RTINDMX.EXE and RTPNDMX.EXE refer to the combined NPL 386/DOS-Extender RunTime, NDM, and the developers own libraries.

NOTE: Niakwa provides linked versions of the Release IV versions of NPL and NDM 1.20 on the Development Software diskettes. As such, no linking is required when using Release IV with NDM where the developers own external routines do not need to be linked in.

Linking of the NDM routines to the NPL 386/DOS-Extender RunTime and NDM 1.20, routines is necessary when using the Release III version of NPL.

Developers who wish to integrate their own external routines using NPL Release III or Release IV must license Phar Lap's 386/DOS-Extender SDK and 386/DOS-Extender Redistribution Package, plus a supported 386 "C" compiler.

All Phar Lap products must be revision 5.00 or greater for Release IV compatibility.

2.4.1 Contents of the 386/DOS-Extender BESDK

The NDM 386/DOS-Extender BESDK diskette contains two directories, \NDM and \NDMEXAM.

The \NDM directory contains the files that, when linked with the NPL 386/DOS-Extender code create the customized version of the NPL 386/DOS-Extender RunTime with Phar Lap and NDM linked in. This directory contains the following files:

MAKEFILE	Commands to create RTIX.EXE and RTPX.EXE
RTP_EXT.C	RTPEXT source code.
RTP_MAIN.C	Mainline.
NDMD3X.LIB	NDM routines in compiled form.

The NDMEXAM directory contains the same files merged with the example external sub-routine from the NPL BESDK package, plus the files necessary to compile and link the example. This is intended as an example for developers to merge in their own external routines.

MAKEFILE	Commands to create RTIX.EXE and RTPX.EXE
RTP_EXT.C	Merged RTPEXT routine.
RTP_MAIN.C	Merged mainline.

2.4.2 Installing the 386/DOS-Extender BESDK

The NDM and NDMEXAM directories should be installed at the same level as the DOSCEXAM directory of the NPL BESDK directory. The MAKEFILE file assumes that this is where the files are located. If these directories are moved to another location, this file must be modified for compiling and linking to succeed.

In the following example, the DOSCEXAM directory of the NPL BESDK is assumed to be in the C:\BASIC2C directory (the full path name of this directory is C:\BASIC2C\DOSCEXAM). It is also assumed that the NDM 386/DOS-Extender BESDK disk is in drive A: on the PC. If this is not the case, substitute the correct names for your system.

Follow the steps shown below to install the NDM 386/DOS-Extender BESDK.

1. Create the NDM 386/DOS-Extender BESDK directory by entering:

```
MD C:\BASIC2C\NDM
```

2. Insert the NDM 386/DOS-Extender BESDK diskette into drive A and copy the files from the A:\NDM directory to the hard drive by entering:

```
COPY A:\NDM\*.* C:\BASIC2C\NDM
```

3. Create the NDMEXAM directory on the hard drive by entering:

```
MD C:\BASIC2C\NDMEXAM
```

4. Copy the files from the A:\NDMEXAM directory to the directory on the hard drive by entering:

```
COPY A:\NDMEXAM\*. * C:\BASIC2C\NDMEXAM
```

NOTE: It is not necessary to create the above directories in the \BASIC2C directory. It is only necessary to create the BESDK directories on the same level as the DOSCEXAM directory from the NDM 386/DOS-Extender BESDK. Refer to Chapter 6 of the Release IV NPL 386/DOS-Extender Addendum in the NPL MS-DOS Supplement for more information on the NPL 386/DOS-Extender BESDK.

2.4.3 Creating Linked RTINDM and RTPNDM Files

This section discusses the creation of the RunTime executables RTINDM.EXE and RTPNDM.EXE. These file are the linked versions of the NPL Runtime (RTI386.EXE and RTP386.EXE) and NDM.

The Make Procedure

Before creating the linked RTINDM.EXE and RTPNDM.EXE, the NPL 386/DOS-Extender BESDK and the NDM 386/DOS-Extender BESDK must be installed on the development system. Refer to the NPL documentation for information on installing NPL and Sections 1.5 and 2.4.2 of this Platform-Specific Addendum respectively for information on installing NDM and the NDM 386/DOS-Extender BESDK.

The steps shown below will create the linked version of RTINDM.EXE and RTPNDM.EXE:

1. Select the NDM BESDK directory by entering:

```
CD C:\BASIC2C\NDM
```

or whatever drive and directory are appropriate.

2. Enter the following to create the linked versions of RTINDM.EXE and RTPNDM.EXE:

```
NMAKE or MAKE
```

Changing the RTK Directory

The MAKEFILE files in both the NDM and NDMEXAM directories declare a variable called RTK that specifies where the Phar Lap run time kit is stored. The default is:

```
RTK= C:\PHAR51\RTK
```

If the Phar Lap product is not stored in this directory, the above line must be changed to specify the correct directory.

2.4.4 Merging the External Libraries

To merge two external libraries follow these steps:

1. Copy the files in the NDM 386/DOS-Extender BESDK directory to the directory in which the merged library is to be created.
2. Modify the RTP_EXT.C file as follows:
 - Add the C declarations of the other library's routines at the start of the file before the C declarations of the NDM routines.
 - Add the NPL definitions for the other library's routines to the beginning of the switch statement. The rtpdef_next_number field of the last definition that is added must contain the DEFFN' number of the first NDM DEFFN' (31010).
 - Modify the rtpdef_next_number field in the default section of the switch statement to be the lowest DEFFN' number of the NPL definitions being added.

For an example of these changes review the RTP_EXT.C file in the NDMEXAM directory.

3. Modify the RTP_MAIN.C file as follows:
 - Add the initialization and termination routines for the other library to the start of the file.
 - Add a call to the other initialization routine immediately after the call to ndm_init().
 - Add a call to the other termination routine immediately before the call to ndm_done().

For an example of these changes review the RTP_MAIN.C file in the NDMEXAM directory.

4. Modify the MAKEFILE file by adding the statements necessary to compile and link the file(s) containing the other external subroutines.
5. Run the NMAKE or MAKE program to compile and link the files according to the instructions in the MAKEFILE file.

NOTE: The NPL external routine definitions in RTP_EXT.C are actually calls to a routine (in the same file) called set_sub(). The parameters to this routine are the values to be placed into the rtpdef structure. The set_sub() routine copies them into this structure. This routine is used to make the code size of the external library slightly smaller than if this copying is repeated for each case within the switch statement.

2.4.5 Using Non-C External Routines

If the other external routine definitions are written in Pascal or assembly language it is necessary to do one of the following.

1. Convert these routines to C.
2. Convert the RTP_EXT.C and RTP_MAIN.C to the other language.

This should be a simple line-by-line translation. However, depending on the other language and compiler, it may be necessary to put underscores ("_") at the beginning of each routine name.

2.4.6 Using the Merged Library

The merged RTINDM, RTPNDM, RTINDMX or RTPNDMX executables files produced by the above steps contain the Phar Lap routines, the user external routines, or both and the NDM API routines.

To install these linked executables on any system, simply copy the RTINDM.EXE, RTPNDM.EXE, RTINDMX.EXE, or RTPNDMX.EXE to the NDM directory of a system where NDM has been properly installed.

HINT: To avoid name confusion, rename the RTI.EXE or RTP.EXE file to some other name.

NOTE: A standard NPL RunTime must be properly licensed and installed on every system where the merged library is to be used.



CHAPTER 3

BTRIEVE CONSIDERATIONS

3.1 Overview

This chapter provides information on features and limitations of NDM that are specific to Btrieve.

Section 3.2 lists the native Btrieve field types that are supported.

Section 3.3 provides a list of Btrieve file limits.

Section 3.4 discusses all known Btrieve-specific considerations for use with the NDM.

Section 3.5 discusses the various NDM toolbox features that Niakwa supports under Btrieve.

Section 3.6 discusses Btrieve-specific error messages.

Section 3.7 discusses MS-DOS-specific features of the NDM Utilities.

Section 3.8 discusses the ordering and updating of Novell's Btrieve.

3.2 Btrieve Field Classes Supported

The key types currently supported are defined in the table below:

Native Field Type Number	Field Class	Native Field Name	Min Size	Max Size	Size Increment
1	A	String	1	32511	1
2	N	Integer	2	2	0
3	N	Float	4	8	4
4	A	Lstring	1	255	1
5	A	Zstring	1	32510	1
6	D	Date	4	4	0
7	A	Time	4	4	0
8	N	Packed Decimal	1	255	1
9	N	Numeric (BTRV)	1	255	1
10	N	Unsigned binary	2	4	2
11	N	Long	4	4	0
12	N	BFloat	4	8	4
13	D	Alpha-numeric Date (YYYYMMDD)	8	8	0
14	A	Alpha-numeric Time (HHMMSSHH)	8	8	0
16	A	No Conversion	1	32511	1

The field class types in the above table are defined as:

A = Alphanumeric
 N = Numeric
 D = Date

NOTE: Field Type 16, No conversion performs no conversion from the NPL field type. This is useful for overlay fields or alpha fields that need to be stored in ASCII format. Use of this field type is only for applications that need to be ported to platforms which support other string types (i.e. EBCDIC, for the IBM AS/400).

For further information on the structure of these field types, refer to the Btrieve documentation.

NOTE: The Btrieve documentation states that the exponent of a BFLOAT is biased by 128. This is an error — the bias is actually 129.

3.3 Btrieve File Limits

The file limits for Btrieve with respect to NDM are defined in the table below:

Description	NDM	Btrieve 5.X	Btrieve 6.X
Record length (in bytes)	4090	4090 without compression and 55296 with compression (refer to Section 3.4.1 for details).	4088 without compression and 57000 with compression (refer to Section 3.4.1 for details)
Key length (in bytes)	120	255	255
No. of keys/file (in bytes)	9	24	119
No. of segs/key	8	24	119

3.4 Btrieve-Specific Considerations

The following is a list of Btrieve-specific issues that must be considered when working with NDM for Btrieve:

- When creating an entry in the catalog file, the following sub-fields in the ISAM specific field must be defined:

ISAM CODE	1 for Btrieve.
PAGE SIZE	The default is 0. If specified, it must be larger than the record length of the file. The maximum is 4096 of which 6 bytes are overhead under Btrieve 5.X and 8 bytes are overhead under Btrieve 6.X. If the Page Size is set to zero by the application, then NDM automatically generates a correct page size when creating fixed length records. Page size also depends on the number of key segments. It must be in multiples of 512 bytes. Refer to the Btrieve manuals for more information.
PREALLOCATION PAGES	Default is 0. Refer to the Btrieve manuals for more information.

- The following fields are not used by the MS-DOS implementation of NDM:

INITIAL RECORDS
 INCREMENT SIZE
 MAX INCREMENTS
 MAX INCREMENTS
 FILE WAIT TIME
 RECORD WAIT TIME

- The only valid conversion to/from the NPL date format is the Btrieve date format (field type number 6). Attempts to convert to any other Btrieve field type results in an error.

3.4.1 Btrieve's Data Compression Option

The Btrieve Data Compression option may be specified when a file is created by specifying "Y" in the Data Compression field of the ISAM_SPECIFIC parameter of 31060 NDM_CREATE_FILE. If specified variable length records are used by Btrieve. The Data Compression field is stored in byte 5 of the ISAM_SPECIFIC table. Any value other than "Y" or "y" will cause the file to be created without data compression.

NOTE: Data Compression is supported only on Btrieve versions 5.1 or later.

The NDM Utilities provide for entry of the data compression field as part of the ISAM_SPECIFIC information stored in the Catalog File. The NDM 31070 NDM_CREATE_FILE_FROM_CATALOG function will use the information stored in this field as described above for 31060 NDM_CREATE_FILE.

NOTE: NDM currently does not provide any method for defining the free space threshold. The Btrieve default of 10% is used.

If the Btrieve Data Compression option is to be used, the following parameters must be set when configuring Btrieve:

Single-user Btrieve (MS-DOS)	The Compression Buffer Size (/U) must be specified. This parameter size must be at least equal to (in K) the length of the largest record accessed from any compressed file.
NetWare version of Btrieve	The Maximum Compressed Record Size parameter must be set from BSETUP.

Btrieve's Data Compression option offers several benefits:

- Disk space requirements can be reduced, often substantially.
- Compressed files are treated as variable length files by Btrieve. Refer to the chart in Section 3.3 for details on the size of records allowed by Btrieve and NDM.
- Page Size is set to 1024 when Data Compression is used. This can be overridden by the user.

If this option is in use and an attempt is made to port the data to another NDM-supported platform, the resulting data file will only be created as a compressed file if the respective ISAM supports compressed files. If it does not, the resulting data file will be created normally with the compression parameter ignored.

NOTE: Use of Btrieve's Data Compression option does add some performance overhead in that all records must be compressed/expanded by Btrieve each time they are accessed. However, this performance penalty can be offset by the fact that more compressed records can fit in a data page, thus potentially reducing physical I/O requirements. The exact effect of data compression on performance will vary from application to application and from file to file.

3.5 Toolbox Features

Most native ISAMs provide features that are not supported by all NDM-supported native ISAMs. Therefore, to maximize portability of NDM applications, these features are not normally supported under NDM. However, applications unconcerned about portability may make use of these features through an NDM feature called the toolbox. The toolbox consists of a set of NDM features, each of which may be individually enabled or disabled through a call to API function 31420 NDM_SET_TOOLBOX_STATUS. Therefore, non-portable applications are easily identified by their call(s) to this special API function.

For more information regarding the NDM toolbox feature, refer to Chapter 5 of the NDM Programmer's Guide.

NOTE: The current status of each toolbox feature can be determined by calling another API function, 31310 NDM_GET_TOOLBOX_STATUS.

Below is a list of the toolbox features Niakwa is supporting under Btrieve.

3.5.1 Filename Extensions

When this feature is enabled, the application may specify a filename (to such API functions as 31340 NDM_OPEN_FILE or 31060 NDM_CREATE_FILE) with an extension. Normally, NDM requires that no extension be present, since it supplies its own. However, an application may wish to open valid native Btrieve files that were not created under NDM. Here, the toolbox feature should be enabled. To specify a filename with no extension, but to prevent NDM from appending the default extension to the name, the file name should end in a period.

3.5.2 Key Types

NDM key segments can normally be one of two types: string or integer. When the key types toolbox feature is enabled, all field types supported by Btrieve may be used as key segments. These types are listed above in the table in Section 3.2.

3.5.3 File Limits

Using this toolbox feature allows NDM files to use the Btrieve limits defined in the table in Section 3.3.

NOTE: A maximum number of 24 key segments is imposed by Btrieve 5.X and 119 by Btrieve 6.X. To use more than 24 key segments with Btrieve 6.X, the new '31405 NDM_SET_MAX_KEY_SEGS function must be used. Refer to the NDM Revision 1.20 Addendum for details.

3.5.4 Transaction Processing

This feature allows access to the 31430 NDM_TRANSACTION_ABORT, 31440 NDM_TRANSACTION_COMPLETE, and 31450 NDM_TRANSACTION_START NDM API calls. These are used to logically group a series of file operations in order to treat the series of operations as a single, indivisible operation.

3.5.5 Get/Set Position

This feature allows access to the 31280 NDM_GET_POSITION and 31410 NDM_SET_POSITION NDM API calls, which an application can use to "remember" the current record of a file for later restoration.

3.5.6 Create/Delete Index

This feature allows access to the 31080 NDM_CREATE_INDEX and 31110 NDM_DELETE_INDEX NDM API calls, which are used to create temporary indices on existing data files.

3.6 Btrieve-Specific Error Messages

NDM returns both an NDM and Native ISAM return code (error code) for each NDM API call (refer to Chapter 11 of the NDM Programmer's Guide for a complete list of all generic NDM return codes). The NDM error codes specific to the MS-DOS/Btrieve implementation of NDM can be displayed by using the NDM Utilities and interrupted by referring to the Btrieve documentation.

3.7 MS-DOS Features of the NDM Utilities

The following section discusses MS-DOS specific requirements for the use of the NDM Utilities.

Refer to Section 4.12 of the NDM Programmer's Guide and Section 2.2 of the NDM Revision 1.20 Addendum for complete details of the NDM Utilities.

3.7.1 Export Data Dictionary to IQ Utility

NOTE: The discussion below only relates to the use of this utility when executing NDM under MS-DOS in conjunction with IQ 3.0. If IQ 2.67 (Niakwa version 1.0) or if NDM is being implemented under MS-Windows or the 386/DOS-Extender, the instructions below do not apply.

Under the MS-DOS implementation of NDM, the DDUNLOAD and DDLOAD programs documented in Section 2.2.3 of the NDM Revision 1.20 Addendum cannot be executed with an NPL \$SHELL command because of the large amount of memory these programs use.

It is therefore necessary, under the MS-DOS implementation of NDM, for the user to execute DDUNLOAD before and DDLOAD after executing the NDM Utilities (NDMUTIL).

The general form of the DDUNLOAD command is:

```
DDUNLOAD <IQ 3.0 DD file name> <IQ 3.0 DD text file>
```

where:

IQ 3.0 DD file name The IQ 3.0 data dictionary file name

IQ 3.0 DD text file name The text file name of the converted IQ 3.0 data dictionary file.

For example, to convert the IQ 3.0 DD file name DDMASTER.DAT to the text file DDMASTER.TXT, follow the steps below:

1. Convert DDMASTER.DAT to DDMASTER.TXT. Enter the following from a MS-DOS prompt:

```
DDUNLOAD DDMASTER.DAT DDMASTER.TXT
```

2. Once the text file has been created NDMUTIL can be executed to export one or more NDM data dictionary files. From an MS-DOS prompt enter:

```
NDMUTIL
```

NOTE: When executing the "Export Data Dictionary to IQ" utility under the MS-DOS implementation of NDM, the user is prompted for the name of the IQ 3.0 DD text file instead of the name of the IQ 3.0 DD file. When prompted for the name of the IQ 3.0 DD text file, enter the name that was used in the above DDUNLOAD command.

3. After the NDM files have been exported, it is necessary to quit NDMUTIL and execute the DDLOAD program as follows:

```
DDLOAD -C < IQ 3.0 DD text file name > <IQ 3.0 DD file name>
```

where :

the filenames are the same as used in the DDUNLOAD command, but in reverse order, and the -C flag tells the DDLOAD command to create a new IQ 3.0 DD file.

For example:

```
DDLOAD -C DDMASTER.TXT DDMASTER.DAT
```

converts the DDMASTER.TXT file to DDMASTER.DAT

3.8 Ordering/Updating Btrieve

Btrieve and Btrieve for Windows software from Novell is not included with the NDM software, but is required for use of the NDM. The following information is intended to help clarify exactly what must be obtained to develop and operate NDM.

Btrieve and Btrieve for Windows runtime software is distributed free of charge with Novell NetWare (3.11 and greater). However, stand-alone MS-DOS-based systems and Novell NetWare prior to and including 2.20 require the Btrieve or Btrieve for Windows run time to be installed. These are available from an authorized Novell dealer or through the Novell Professional Developers Program (these products come with an unlimited distribution license).

HINT: Development sites are strongly urged to purchase a copy of the Btrieve Development Package (Btrieve for DOS or Btrieve for Windows) for an internal development reference. The Btrieve for Development Packages contain the appropriate Btrieve run time software required for each system running the NDM, plus the appropriate Programmer's Manual and documentation.

The Btrieve Developer's Kits can be ordered from Novell using the following Novell product numbers.

NOTE: These kits are necessary for NDM development and are available from any authorized Novell reseller or Novell's Professional Developers Program. Call (800) NETWARE for more information on this Novell program.

Product	3-1/2"	5-1/4"
Btrieve for MS-DOS	883-411110-400	883-411100-400
Btrieve for MS-Windows	883-001018-001	883-001017-001

NOTE: Niakwa strongly recommends that developers update their sites to use the latest version of Btrieve as it becomes available from Novell. Novell only provides support for the latest version (which generally corrects problems encountered in the field) and provides these updates free of charge on CompuServe in the NetWire or NOVDEV forums (Niakwa is prohibited from distributing these updates due to Novell's licensing with CompuServe).



CHAPTER 4

END-USER CONSIDERATIONS

4.1 Overview

This chapter provides information on the setup of NDM on end-user systems.

Section 4.2 discusses the minimum file requirements for end-user systems.

Section 4.3 discusses the minimum file requirements for the NDM Error Description File.

Section 4.4 discusses providing the NDM Utilities to end-users.

Section 4.5 discusses the data dictionary files.

Section 4.6 discusses the catalog files.

Section 4.7 discusses the field type file.

4.2 Minimum NDM Software Requirements

There are specific NDM files that must be present at the end-user site. The following lists the files that are necessary:

4.2.1 MS-DOS Requirements

The following is the file necessary on the end-user's system when using the standard MS-DOS NDM:

NDMBTRV.QLB NDM for MS-DOS quick library.

4.2.2 MS-Windows

The following file is necessary on the end-user's system when using the MS-Windows NDM:

NDMBTRV.DLL NDM for MS-Windows dynamic link library.

4.2.3 386/DOS-Extender

The following are the files necessary on the end-user's system when using the 386/DOS-Extender NDM:

NPL Release IV

If the Release IV version of NPL is installed at the end-user site, the following files from the NDM Development Software are required:

RTINDM.EXE The Interpretive version of the Release IV NPL 386/DOS-Extender RunTime linked with NDM 1.20.

RTPNDM.EXE The Non-interpretive version of the Release IV NPL 386/DOS-Extender RunTime linked with NDM 1.20.

NPL Release III

If the Release III version of NPL is installed at the end-user site, the Release III version of the above executables must be created by the developer using the linking method described in Section 2.4.

NOTE: Only an NPL Release IV linked version (RTINDM.EXE and RTPNDM.EXE) is provided as part of the NDM Pak files for the MS-DOS platform implementation of NDM.

4.3 NDM Error Description File

If the application uses the API function call error description 31210 NDM_GET_ERROR_DESCRIPTION, the following file must be provided to the end-user:

NDMERR.DAT	List of basic NDM error messages and any customized errors.
------------	-------------------------------------------------------------

4.4 Providing the NDM Utilities to End-Users

If the developer wishes to install the NDM Utilities on the end-user's system, the following files must be provided:

NDMUTIL.BAT	Program to start the NDM Utilities.
NDMUTIL.BS2	The NDM Utilities diskimage.
NDMCAT.DAT	Catalog file.
NDMCATD.DAT	Data description file for the catalog file.
NDMCATK.DAT	Key description file for the catalog file.
NDMDDDD.DAT	Data description file for data description files.
NDMDDKD.DAT	Key description file for data description files.
NDMERR.DAT	Error message file.
NDMERRD.DAT	Data description file for the error message file.
NDMERRK.DAT	Key description file for the error message file.

NDMFTF.DAT	Field type file.
NDMFTFD.DAT	Data description file for the field type file.
NDMFTFK.DAT	Key description file for the field type file.
NDMKDDD.DAT	Data description file for key description files.
NDMKDKD.DAT	Key description file for key description files.
NDMREL.DAT	Relation file.
NDMRELD.DAT	Data description file for the relation file.
NDMRELK.DAT	Key description file for the relation file.
NDM.HLP	NDM Help file. Contains descriptions of the NDM functions calls.
NDM.IDX	Index for NDM.HLP file.
NDMUTIL.OBJ	Boot program used when starting the NDM Utilities.

4.5 Data Dictionary Files

If the application's data dictionary files are accessed under program control, then the following files must be installed on the end-user's system.

NDMDDDD.DAT	Data description file for data dictionary files.
NDMDDKD.DAT	Key description file for data dictionary files.
NDMKDDD.DAT	Data description file for key description files.
NDMKDKD.DAT	Key description file for key description files.

However, if the data dictionary files are not accessed directly, then the end-user does not need these files.

4.6 Catalog File

If the application builds catalogs under program control, then the end-user needs the following files:

NDMCATD.DAT Data description file for the Catalog file.

NDMCATK.DAT Key description file for the Catalog file.

4.7 Field Type File

If the application uses **31200 NDM_GET_DEFAULT_FIELD_TYPE**, then the end-user needs the following file:

NDMFTF.DAT Field type file