



esXpress 4.0
Restoration and Disaster Recovery Guide

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Documentation Updates

The following table contains updates made to this document. To verify that you are using the latest edition of a document, check the PHD Virtual website.

Chapter	Version	Description
All	3.6	Updated formatting and made general editing changes.
1	4.0	" Restoration Types " (on page 10): added information for Management Appliance restores.
3	4.0	" Restoring a VM Using the Management Appliance " (on page 35): added information for restoring backups using the Management Appliance.
3	4.0	" Advanced Restoration Options " (on page 36): added section that describes how to use the advanced (DeDupe Only) restore options.
2	4.0	" Replication " (on page 31): updated section to reflect version 4.0 Management Appliance options.

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Chapter 1 - Restoration and Disaster Recovery with esXpress

The most important feature of any backup product is the ability to restore. While all products can restore a backup under ideal conditions, it is the ability to restore under any condition that differentiates a backup tool from a disaster recovery tool.

esXpress provides maximum flexibility when restoring virtual machines (VMs). For example, you can restore to an ESX host in your data center or to your Windows laptop running VMware Server. There will be many times when it will be necessary to restore one or more virtual machines. Most of these will be in the course of daily business, such as restoring a virtual machine in its entirety, or just a single file. There may also be a time when you experience a catastrophic interruption like fire or a natural disaster, or something less dramatic, like simply needing to evacuate your building due a gas leak in the building next door. In each case, your business still needs to continue to operate, and with esXpress, your entire virtual environment can be restored and running in hours.

Virtual Machines are Simply a Collection of Files

While your virtual machines may appear to be actual devices, they are in fact just files and are no different than a word processing document, a spreadsheet or an image file. Each virtual "device" is encapsulated within a virtual machine disk file (VMDK). Therefore, simply copying the file will result in a copy of your "device." esXpress provides 100% recoverable copies of these files.

Virtual machine backups contain everything that makes up a virtual machine: the operating system, the data, and the applications that make the data meaningful. While this is very convenient, unless your backups are encrypted, it can also be a dangerous convenience. Just as easy as it is to share a spreadsheet with a coworker, virtual machines allow anyone who has access to your backups to restore them. esXpress compensates for this danger by adding optional government standard AES-256 encryption, making your backups safe to transport across town or across the Internet.

esXpress backups are portable and the software required to restore each virtual machine is built into the backup file itself, making the archives self-executing. In an emergency, you only need your backup files, not the esXpress software or license, to recover your VMs. Backups can be extracted on a variety of platforms and optionally, esXpress can secure your backups with 256-bit encryption. In this way, esXpress simplifies the complexities of VMware backup and recovery while ensuring your business is always protected.

No matter what the reason or circumstances, whether restoring a single virtual machine or hundreds, esXpress is designed to assist the administrator as quickly and reliably as possible.

This guide describes how to configure and implement the restore options available with esXpress.

esXpress Restore Features

esXpress restore options include the following:

- Multiple backup targets: your backups can be accessed via local VMFS storage or remote FTP.
- 256 bit Encrypted ESX VMDK Backups. Each backup is optionally encrypted and can only be restored with the proper- password.
- Menu driven, no scripting required.
- Real-time monitoring and statistics.
- Ability to cancel restores.
- Restore your entire environment or a single server to almost any point in time.
- Self-extracting restores require no client software to get your backups up and running.
- Disaster Recovery: restore your entire business in hours, not days.
- Simple “One to Many” replication.
- Restores onto the VMFS resulting in zero to minimal fragmentation.
- Restore your backups to VMware Server/GSX/Workstation on Windows or Linux.
- Multiple background restore jobs.
- Instant GUI-driven File Level Restores from DeDupe backups.
- Restore VMs from the Management Appliance, Restore Now page.

FULL and DELTA Backup Archives

When running Full/Delta backups, esXpress will create two types of archives, FULL and DELTA.

A FULL archive is created in the following circumstances:

- The first time a virtual machine is backed up by esXpress.
- The virtual machine or host was scheduled to run FULLS.
- The DELTA threshold had been exceeded.

A FULL archive is either a GZIP or LZOP compressed archive of a VMDK file, optionally encrypted with GPG. This archive can be restored on any Windows, Linux or ESX platform using both free open source utilities like LZOP or commercially available products like WinZip. You do not need the esXpress software to restore a FULL archive created with esXpress.

If the conditions for making a FULL backup have not been met, a DELTA archive is created by default. A DELTA is a true block level differential of the last FULL backup. Only one FULL and one DELTA file are required to restore any virtual machine.

DELTA archives also contain the virtual machine configuration (VMX) and non-volatile RAM (.NVRAM) files. When esXpress creates a FULL archive, it will also create an empty DELTA archive. Empty meaning it will contain no delta blocks, but it will contain the VMX and NVRAM necessary to rebuild the entire virtual machine.

So assume for example that your backup schedule is creating a FULL archive on Sunday and DELTA archives Monday through Saturday. To restore to Thursday’s backup would require Sunday’s FULL and Thursday’s DELTA. esXpress maintains an index map of the FULL backup, meaning no access to the

original FULL archive is required in order to create a DELTA archive. This is efficient, allowing you to purge archives to tape.

For instructions on restoring Full and Delta backups, see ["Restoring Virtual Machines"](#) (on page 16).

DELTA vs FULL Restores

When restoring backups, it is always preferable to restore a DELTA backup instead of a FULL. While restoring a FULL backup is faster than restoring a DELTA, DELTA restores have advantages over the FULL.

If you are restoring a FULL backup, it is simply restored as a plain file as it is uncompressed. Because the FULL is simply a GZIP or LZOP archive, there is no way to know the actual uncompressed VMDK size. The system will therefore write out the new file one block at a time, the same as the copy or tar command would. Because the VMDK is not pre-allocated, restoring multiple virtual machines to the same VMFS file system simultaneously would effectively interleave the two VMDKs, causing severe fragmentation and definitely affect the performance of the virtual machine.

When esXpress restores a DELTA archive, it knows the exact size of the VMDK, as this information is stored in the DELTA archive. This allows esXpress to create the VMDK file on the VMFS first, and then import the backup archive into that pre-allocated VMDK file. This is the proper way to write to the VMFS. Because of this import, you can restore multiple VMDK files to the same VMFS at the same time with no risk of fragmentation.

When esXpress creates a FULL archive, it always creates an empty DELTA archive as well. This DELTA backup contains the metadata information about the backup including the original VMDK file sizes, along with VMX file and the index maps. Restoring a FULL using the empty DELTA will allow you to perform multiple FULL restorations against the same VMFS with no risk of interleaving.

When esXpress DELTA backups are restored, the restored file is checked block-by-block on restoration against the index map. If there are any problems, like insufficient free space, or a checksum error, the restoration is aborted. If you were to lose a FULL archive, and try to rename a previous FULL to replace it, it will not succeed. The checksums will not match the index map and the restore process will be aborted.

Portable Self-Extracting Encrypted Delta Block Backups

While the technology has a complicated name, the concept is a simple one; create an archive file that is completely portable between all VMware platforms and operating systems while maintaining security.

This self-extracting archive is what differentiates esXpress from other products and why it is truly a disaster recovery tool as much as a daily backup utility. Archives created with esXpress are actually executable programs containing all the logic necessary to restore and register a virtual machine without the need for the esXpress software or license key.

esXpress Delta archives contain not only the virtual machine disk files (VMDKs), but also the configuration and NVRAM files, everything you need to completely restore a virtual machine. This allows for effortless restorations regardless of circumstance or platform. It also allows for easily and securely sharing virtual machines with co-workers who might not have access to the esXpress software or VMware platform.

DeDupe Backups

With the 3.5 release, esXpress introduced Data DeDuplication to its backups. These backups are sent to the esXpress DeDupe Appliance, which can be used as another backup target for esXpress hosts. To create DeDupe backups, the system backup mode must be set to PHDD.

The Delta/Full model does not apply to the deduplicated backups. Instead, these are 'Virtual Full' backups. In a restore situation, you need to choose the point in time for a virtual full backup that you wish to restore.

As of version 3.5-9, DeDupe backups can be restored using the Virtual Backup Appliances (VBAs). Using VBAs to perform the restores offloads I/O from the service console and allows for more concurrent restores, depending on the number of VBAs you have configured. Two options control this feature.

In the **Management Appliance**, Global Settings, Replication Tab:

- **Use VBAs for restores** - Enabling this option allows restores through the VBAs instead of doing a restore through the service console.
- **Threshold before using VBA for restore** - This determines the threshold for when to do a VBA restore. This setting is in megabytes and determines the level of blocks to restore before using the VBA. The default is 2000 MB (2GB). You do not want to set this value too low as there is an overhead to start and stop the VBA, so for a small amount of data, restoring through the console will be faster.

In the **PHD text** menu on the host:

- **Use VBAs to do actual restores** – Enabling this option allows restores through the VBAs instead of doing a restore through the service console.
- **Set Change Block Threshold for VBA Restore (2000)** – This determines the threshold for when to do a VBA restore. This setting is in megabytes and determines the level of blocks to restore before using the VBA. The default is 2000 MB (2GB). You do not want to set this value too low as there is an overhead to start and stop the VBA, so for a small amount of data, restoring through the console will be faster.

Restoration Types

esXpress allows you to restore data multiple ways, allowing you to react quickly to any circumstance.

- Command Line
- Console Menu
- Automatic Mass Restore
- Replication
- Management Appliance

Command line restorations are ideal for disaster recovery where you may not have the resources or time necessary to build an environment capable of point and click restores. It is also useful for those that are comfortable with the Linux/ESX command line.

Console menu restorations allow you to restore virtual machines using a text menu interface. This is useful for when you are in the data center or physically logged on to the host. The host console menu is also available via any SSH connection. This option requires minimal bandwidth and can be performed remotely even across dial-up connections.

Automatic Mass Restores are useful in a disaster recovery situation where the administrator must restore dozens or hundreds of virtual machines with little or no user interaction.

Replication with esXpress is basically repeated, scheduled restorations. This option is useful if you need to replicate your environment to a co-location, allowing for a complete warm standby data center.

Management Appliance restores are available using the Management Appliance web interface, Restore Now page. Use this page to select the backup to restore and the target host to restore to. Refer to the esXpress Management Appliance guide for details.

File Level Restores

esXpress offers three types of File Level Restores. In version 3.1, the primary method was to run the esXpress File Level Backup Feature and then perform File Level Restores from those separate backup archives. If you are running Delta/Full VMDK backups, it is possible to do File Level Restores, although esXpress does not have any specific built in text menu or GUI function to do this. With the 3.5 release, if you are running DeDupe backups, you can do Instant File Level Restores (FLR) from the esXpress DeDupe Appliance web interface.

- ["Restoring File Level Backups" \(on page 11\)](#)
- ["File Level Restores from VMDK Backups" \(on page 11\)](#)
- ["Instant GUI FLR from DeDupe Backups" \(on page 11\)](#)

Restoring File Level Backups

File level backups are accomplished by creating a GZIP or TGZ file on a network share. Because of that, the backups can be restored by the end users and therefore there isn't any built in esXpress restore feature at this time.

What we recommend is that you identify the correct dated FLB backup and use whatever tools you are comfortable with to uncompress the file (for example WinZip). Then extract the needed file or files from that archive and copy them to your associated virtual machine.

File Level Restores from VMDK Backups

For file level restores with esXpress from VMDK backups you will need to restore the VMDK image and mount that VMDK to restore the file or files from it. There are a couple of different options we recommend.

- On your backup server (if backing up to FTP for example), install VMware Server, restore the VMDK there, mount it in a helper VM, and then extract the files. (If using Windows, you need CYGWIN installed to restore the delta backups).
- On a DEV ESX host, restore the VMDK there, boot it up in host-only mode, or again mount the VMDK in another VM and extract the files from there

Instant GUI FLR from DeDupe Backups

Beginning with esXpress 3.5, instant file level restores (FLR) are capable through the DeDupe Appliance web interface. You must be running Data DeDuplication backups (PHDD mode) in order to do instant file level restores. This is not available for traditional Delta/Full backups. For additional information on DeDupe File Level Restores, refer to the separate esXpress DeDupe Appliance Guide.

Other Restore Considerations

If restoring to VMware Server or GSX on Windows, you will need CYGWIN.

If restoring encrypted archives, you will need the GPG 1.0.6 RPMs installed. This is required for all restoration platforms including ESX, Linux and Windows.

Installing esXpress

Refer to the following guides for planning and installation information for the esXpress components:

- *esXpress Getting Started Guide*
- *esXpress Management Appliance Guide*
- *esXpress DeDupe Appliance Guide*

For information on using the PHD text menu installed on each ESX host, refer to the *esXpress Reference Manual*.

FAQs

Q: Can I restore my esXpress backup on my Linux backup server?

A: Yes, the delta backup file is actually a Linux program, you can run it on any Linux host. Because of this, you do not need our esXpress software to do recovery. Not only can you rebuild the VMDK file on your Linux machine, but you can use the VMDK directly with VMware Server (or GSX) on that Linux machine. With a helper machine you can mount backup copies of VMDKs and easily recover files or data.

Q: Can I restore my esXpress backups in Windows?

A: Yes, (See Previous Question) With the CYGWIN environment installed on your Windows server you can execute the backup file just like it was Linux and restore your backups. This includes encryption. This way on your Windows FTP server you can restore a VMDK backup, and use it directly in Windows with VMware Server

Q: When I try to run the 'phd' menu or go to a different menu item, nothing happens, the screen just flashes.

A: You probably are using a terminal program (such as Putty) and have your window too small. The menu requires a minimum screen size equal to the console (80 x 24 characters).

Q: How do I know what my maximum FTP speed is?

A: You can test your FTP speed from the 'C' Configuration Menu. Select Option 'F' for the FTP server configuration menu. Then select option 'D' Do FTP Speed Test. This test will send a 200 meg file of NULLS to the FTP server. It will give you the maximum speed you can achieve through FTP. This speed is based on the console NIC, the network, the ftp server NIC and writes speed. If this speed test is not positive, if you are achieving less than a couple of MB a second, then you have a problem. Check your FTP server, is it out of space? Is your NIC duplex ok? Are you getting switch errors?

Q: My NIC is only 100MB, would using Gigabit be better?

A: Yes, you will get faster backup speeds on a gigabit NIC

Q: When I run the FTP Test it does not work, but the FTP Speed test is successful. Why?

A: The FTP test and FTP Speed are 2 different FTP methods that are both used to make backups. Try using the IP Address instead of the DNS name for the FTP server.

Make sure the FTP user has full permissions on the FTP path, on the FTP server. It needs to mkdir, write, rename, dir, delete, full control.

Make sure you enter a path for the FTP Folder. If you leave it blank, it will not work.

If you are using a Domain\User for the FTP user, you must enter it as 'Domain\\User', but only one '\' will show after hitting Enter. (Because Linux is eating the first \).

Q: I use IIS for my FTP server, and when I restore small VMDK files everything works fine, but when I restore large ones, there is always an ERROR.

A: IIS is not a robust FTP server. When you send large backup archives, we have seen IIS pretend to complete the backup, but instead actually truncates the file. When restoring from IIS, often it will refuse to download files larger than 4GB. We have also seen it just timeout on the ftp transmission, even though it is actively writing and the backup file is growing in size (on the FTP server). IIS is definitely not a commercial quality product and we highly discourage its use. There are many third-party FTP servers available for Windows with Filezilla being both free and stable.

Known Issues

Opteron CPUs and Checksum Errors

Occasionally, checksum errors may occur during a restore. When verifying Delta blocks or performing a restoration (which also verifies the delta blocks), esXpress may detect that a checksum does not match. The Delta blocks are checked against the Delta Index that was made during the first stage of the Delta Backup.

If backups are being made and restored on Intel-based hosts, a checksum error indicates the archive is invalid. Otherwise, if using an AMD Opteron platform, the error is most likely due to the "Opteron Bug," when in a tight loop performing repetitious mathematical functions, sometimes the CPU will "flip a bit."

This is a very tight loop that computes the checksums. For a 10 GB file it would loop 40,000 times doing the same checksum calc routine, over and over again.

In proving this, we start with a 10GB VMDK file. Then, on an Intel based host, we compute the md5 checksum for each 256k block of data, or 40,000 total. Then on an Opteron based host, using the same VMDK file, we perform the same task, comparing the checksum to the control list. Very often, the system would report a checksum that did not match, even though the file is verified valid. This test is repeatable with predictable results.

This checksum does not affect the backup file. The problem esXpress detects is that a Delta Block does not match its checksum value. The value of the checksum is incorrect, but the data in the Delta block is correct.

Chapter 2 - Restoring Virtual Machines

esXpress can restore archived data over the network, from attached storage (SAN, iSCSI, NFS, local), from the esXpress DeDupe Appliance, or in the case of a DELTA restore, from both media simultaneously.

If restoring esXpress backup archives from a network server make sure you have the following information:

- Name/IP Address of FTP/SSH Server
- Port
- User ID
- Password
- Path to Backup Folder
- The FTP/SSH user must have complete access to the share; it must be able to create folders and files, rename and delete files.

As a security precaution, you must also have root access to the VMware host to install and execute the esXpress software.

Note: If your backups are stored on either a Windows Server product running IIS, or a Windows-based hardware appliance, note that Microsoft's FTP implementation is flawed and unreliable when working with files larger than 4 GB in size. Backups made via a Microsoft IIS server may not be restorable. We strongly advise using a commercial quality FTP package (Filezilla, for example).

esXpress offers multiple options for restoring virtual machines. The following sections explain these in detail:

- ["Restoring VMs Using the Command Line"](#) (on page 17)
- ["Restoring VMs Using the esXpress Menu"](#) (on page 23)
- ["Automatic Mass Restore"](#) (on page 30)
- ["Replication"](#) (on page 31)
- ["Restoring a VM Using the Management Appliance"](#) (on page 35)

Restoring VMs Using the Command Line

With esXpress you don't need to have the software installed on your host to restore your Virtual Machine's VMDK files. For example, in a DR scenario, you may be recovering to a new host that does not have esXpress installed. It is important to note that esXpress is a VMDK restoration product, so each VMDK is restored separately and optionally, along with the VMX file. In a DR scenario we recommend pre-creating your Virtual Machine from the VI3 or vSphere client first and then starting the esXpress restores. This way, the VMX is setup correctly and the correct folders to restore the VMDK into already exist.

For additional information, see the command line restore help file.

Full Backup Archives

There are two methods for restoring full backup archives.

Method 1 (recommended)

Every time esXpress creates a Full Backup it also creates an empty Delta archive. You can use this empty delta archive to restore your Full Backup. This method enables the built-in menu within the delta and requires less manual steps. It will also verify the blocks in the backup archive. This process is described in detail in the section "Delta Backup Archives" (on page 18).

The following is an example directory listing showing empty delta backup with the Full Backup file.

```
drwxr-xr-x 15 ftp ftp 4096 Apr 29 11:41 ..
-rw-r--r-- 1 ftp ftp 2097171 Apr 29 11:54 00-RedHat_VM1.vmdk.delta-2008.04.29-
1134-080429-1134.phd
-rw-r--r-- 1 ftp ftp 1000739843 Apr 29 11:54 00-RedHat_VM1.vmdk.gz-080429-1134.phd
```

To restore the Full backup in the example above, run the following command:

```
sh 00-RedHat_VM1.vmdk.delta-2008-04.29-1134-080429-1134.phd
```

Method 2

esXpress Full Backup archives are nothing more than compressed (gzip or lzop) VMDK file. To restore these archives without the esXpress software, uncompress the file.

Example:

```
-rw-r--r-- 1 root root 5368709120 Apr 29 13:32 00-RedHat_VM1.vmdk.gz-080429-
1134.phd
```

The example above is a gzip full backup archive. To decompress this file, run the following command (note the file ends in .phd so you need to use -S option for gzip):

```
gzip -d -S phd 00-RedHat_VM1.vmdk.gz-080429-1134.phd
```

The unzipped VMDK file you will restore with this method is actually the flat file. You still need to create the stub file to be able to use this archive. There are a couple of different methods you can use.

- Pre-create the VM in the VI3 or vSphere client with an empty disk that is the same size as the restore VMDK. Then overlay the -flat file with the restored VMDK.

Use the esXpress stub generator program to create the stub file <http://www.esxpress.com/tools/wrapgen.php>

- If you choose to manually copy the file, make sure you copy it using the correct name (for example, RedHat_VM1-flat.vmdk). Be careful when manually copying files, make sure the new VM is powered off and you are not overlaying the wrong file.

Delta Backup Archives

All esXpress Delta backups are self-extracting executable Files. To restore the Delta backup archive you would shell the backup. For example:

```
sh 00-RedHat_VM1.vmdk.delta-2008.04.29-1157-080429-1134.phd
```

This command will launch a mini esXpress restore Menu which will walk you through the restore process.

The top section of the menu shows information regarding the Delta archive including the host it was initiated from, the VMDK file, and the total Delta Blocks. The following figure shows an example.

```

=====
Host: esx1
DSK File: /vmfs/volumes/LOCAL_ESX/RedHat_VM1/RedHat_VM1.vmdk
DSK Blocks: 20480
DSK Size: 5368709120
This File: 00-RedHat_VM1.vmdk.index-2008.04.29-1157-080429-1134.phd
Starting: Tue Apr 29 12:03:17 EDT 2008

DSK Delta Index created using Master Index:
=====
Index: /pub/vm/phd/00-RedHat_VM1.vmdk.index-080429-1134.phd.gz
Host: esx1
DSK File: /vmfs/volumes/LOCAL_ESX/RedHat_VM1/RedHat_VM1.vmdk
This File: /pub/vm/phd/00-RedHat_VM1.vmdk.index-080429-1134.phd
Starting: Tue Apr 29 11:39:22 EDT 2008
=====
Total Delta Blocks: 316

```

The second section of the menu shows the Full Backup Archive that this Delta is using. For Delta restores you need the matching Full Backup, so make sure you restore the matching full as well to the new ESX host and it is accessible.

The third section is the Various Menu Options for the Delta restore. These include restoring the Delta backup, validating the new VMDK as well as the Full archive among other options. The following figure shows an example menu.

```

R. Restore this INDEX BACKUP and create a new VMDK
D. Verify Delta Blocks in this INDEX BACKUP file
M. Validate FULL BACKUP as correct
N. Validate NEW VMDK as correct
A. Enter 'A' or 'auto' to restore VMDK with default options.

F. Configure FTP
V. VMX Menu
C. Create VMDK Stub File.
H. Help

Q. Quit

Your Command? █

```

The following table lists the menu options and their descriptions.

Table 1 - sh Delta Restore Menu Options

Option	Description
R	Restore this INDEX BACKUP and create a new VMDK.
D	Verify Delta Blocks in this INDEX BACKUP file.
M	Validate FULL BACKUP as correct. Validates and checks the FULL archive to see if it matches the Delta.
N	Validate NEW VMDK as correct. Validates VMDK against the backup.
A	Automatically restore backup using all defaults.
F	Configure FTP.
V	Show the VMX restore menu.
C	Create VMDK stub file for GSX/Server.
H	esXpress Restore Readme.
Q	Quit the application.

A detailed explanation of each option follows in the next few sections.

R - Restore This Index Backup and create a new VMDK

Choose this option to restore this backup file and create a new VMDK file. You are asked for the new name to restore as, but it defaults to the current VMDK name. When a backup is being restored, the FULL backup is pulled directly from the FTP server (unless it's locally on the same drive as this backup file) and a new VMDK file is created. If you are restoring this backup on ESX, then you can safely do more than one restore at a time, as the new VMDK is created using vmkfstools, then the backup is imported directly into this new VMDK file. Otherwise, restoring more than one backup on the same file system will create severely fragmented files.

The first thing you need to do is select which Full backup archive to use. The menu will present a default if it finds one either local or from FTP if configured. You can accept the default by just hitting Enter or provide the full path and file name.

The second step is to define the new VMDK name included in its Full Path. Hit Enter to accept the default or provide the new name and full path.

The last step is to confirm your choices and proceed with the restore. You must enter yes to continue, enter q to quit.

D - Verify Delta Blocks in this INDEX BACKUP File

This option will verify the Delta blocks in this INDEX backup. When you are doing a RESTORE, only the first 3,000 blocks will be checked, so choose this option if you want to verify all blocks beforehand.

If the verify is correct you will see the following message:

```
CHECKSUMS ALL GOOD IN DELTA FILE
```

M - Validate FULL BACKUP as correct

This option will validate a VMDK as the FULL Backup that was used when this INDEX backup was made. If the file is local it will be used. If FTP is configured, then the FULL backup will be pulled and verified through FTP.

When the Full verification is complete you should see a message similar to the figure below, showing the Master is 100% verified and that Full Backup VMDK verify is complete. If an error is shown, there was a problem with the Full Backup that needs to be investigated.

```
Master Verify: 100%, 5100 mb of 5120 mb, at 44 meg/sec, Total Seconds: 114
Total Blocks: 20479, Processed: 20480
FULL Backup VMDK verify complete
Completed at: Wed Apr 30 16:44:38 EDT 2008
Press ENTER to continue.
```

N - Validate NEW VMDK as correct

This option will validate a VMDK and compare it to the INDEX Backup that was used to make this INDEX backup. This is also done when a RESTORE is completed.

A - Automatically restore backup using all defaults

The auto restore option will use all the Default settings when restoring the VMDK. For example, the default name, the original location, etc. When you choose this option you will be prompted to confirm if you wish to continue. Enter yes to confirm or no to abort the restore.

After you've entered yes, you will see the default values used for the restore. The answer Autorun Restore is automatically set for each question for the restore. They include the correct Full Backup and the path for the new VMDK. Before choosing the auto run restore, make sure the correct Full Backup is accessible either by configuring FTP or copying the matching Full Backup to the same directory as the Delta you are restoring.

The following example shows the new VMDK created using vmkfstools which the restore backup will be imported into.

```
*****
* Ready to create a NEW VMDK from INDEX Backup *
*****
Accessing FULL BACKUP from File
../2008.05.02-Fedora_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-Fedora_
VM1.vmdk.gz-080502-1113.phd
Create NEW VMDK File: './Fedora_VM1-flat.vmdk'
Ready to continue (Enter 'yes' to continue, 'q' to quit)? Autorun Restore
*****
* Checking if Import VMDK is available. *
*****
```

The next step in the autorun restore is the verification of the Delta blocks in the backup. The last messages you will see are the running status of the backup restore. In the example below 69% of the Delta backup has been processed so far and 45% of the Full has. The estimated time remaining for the restore is 3 minutes and 21 seconds.

```
+++++
Delta Blocks Found: 255
```

Chapter 2 - Restoring Virtual Machines

```
Restoring VMDK file: ./Fedora_VM1-flat.vmdk, 20480 Blocks in file
+++++
Delta: 69% Full: 45%, 2300 mb of 5120 mb, at 14 meg/sec, Elapsed: 02:41s
Remaining: 03:21s
```

After successful completion of the Autorun Restore you will see messages similar to the following example, showing a good checksum and the successfully created VMDK files.

```
Delta: 100% Full: 100%, 5100 mb of 5120 mb, at 14 meg/sec, Elapsed: 06:03s
Remaining: 01s
Total Blocks: 20480, Processed: 20480
```

```
=====
CHECKSUMS ALL GOOD IN VMDK FILE:
../2008.05.02-Fedora_VM1.564d1e34-4364-1808-23fd-e56565add965.FULL/00-Fedora_
VM1.vmdk.gz-080502-1113.phd
```

```
=====
+++++
Skipping Verify of NEW VMDK file
VMDK successfully created: './Fedora_VM1-flat.vmdk'
-rw----- 1 root root 5.0G May 5 11:02 ./Fedora_VM1-flat.vmdk
VMDK successfully created: './Fedora_VM1.vmdk'
-rw----- 1 root root 376 May 5 14:10 ./Fedora_VM1.vmdk
Completed at: Mon May 5 14:16:41 EDT 2008
Thank You for using PHD esXpress v3 Backups, www.esxpress.com
```

C - Configure FTP

From within the restore menu you can set up an FTP server if needed to download the matching Full backup for the Delta backup being restored.

V - Show the VMX restore menu

This menu will allow you to restore the VMX file, NVRAM, and logs from when this backup was made. You can save it to any path, and it will ask if you want to register the VMX file. Do not use an ESX VMX file with GSX/Server. Make a new one using the old one as a guide.

C - Create VMDK Stub File

You can use your ESX VMDK files directly with other VMware products. There is almost no difference between an ESX VMDK and a GSX/Server Pre-Allocated disk. If you create a STUB file that points to the ESX VMDK then you can use it directly on your Backup server or any machine. When you configure an **Existing Virtual Disk**, point to the STUB file. Make sure the VMDK and the STUB file are in the same folder if you move them.

Encrypted Archives

You can restore encrypted delta archives as well with this command line method without the esXpress software installed.

In this case, an additional menu option will be shown to Set the Passwords to be used for the encrypted archive.

```
P. Set Passwords - PASSWORDS SUCCESSFULLY SET
P. SET PASSWORDS
```

This option allows you to set the password for this backup file and the password for the FULL backup. If you are restoring from the PHD menu, then the passwords will be passed from the menu to this restore program. You can also set Environment variables.

Best Practices

esXpress is a VMDK restore-based product. With this in mind, we recommend that in a DR scenario or when you are restoring to an ESX host without the esXpress software installed, to re-create the Virtual Machine from within the VI3 or vSphere client.

While esXpress can restore the VMX file from the original backup, we do not make any changes to it. So with a new host where they could be different settings in the VMX (for example, VM location, different datastore, possible duplicate VMDK names, network differences, VM memory allocation and others) esXpress does not attempt to update the VMX file directly and cause possible additional issues.

For this reason, it is recommended that you create the VM in the client, first, before running the restore. When creating the VM, set the following settings:

- VM Name and location
- DataStore
- Resource Pool if applicable
- CPUs
- Memory
- Network
- Virtual Disk(s) - create the virtual disk the same size as the original VMDKs from the backups.

When finished, you will have a fresh VM set up correctly for the new host and then can just restore the esXpress VMDK backup directly over the blank VMDK you created with the VM. This makes for a much cleaner restore and recovery.

Note: If you do choose to restore the VMX from the backup, this will work but you need to go to the client and make any necessary changes to the VM as a result of the new ESX host environment.

Restoring VMs Using the esXpress Menu

You can restore virtual machine backups using the esXpress text menu options.

To restore a VM using the esXpress text menu

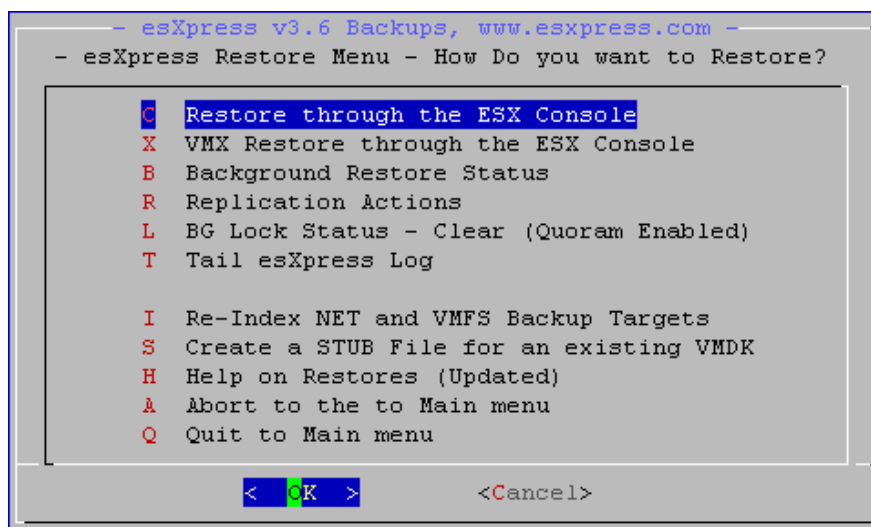
1. Open esXpress text menu by logging in to your ESX host and type **phd** at the command prompt. The esXpress Main Menu opens.

```
- esXpress Main Menu - www.esxpress.com -  
  
vers 3.6-4 - sandboxdoc - Thu 2009/08/27 16:56:02  
License Type: ENT expires 2009-09  
  
Current Running Status - -ERRORS TODAY  
Daemon Status - Enabled, Running  
U Setup Quick Menu  
L Lock Status - Clear (Quorum Enabled)  
D Daily Backup Report  
O Backup ONE VM Now  
A Backup ALL VMs Now  
P Backup ONE Template VM Now  
T Tail Backup Log  
C Configuration Options  
R Reports Menu  
E Restoration Menu  
M Maintenance Menu  
Q Quit  
  
< OK > <Cancel>
```

The menu contains the following status indicators:

- **Current Running Status** – shows you if backups are currently running and lets you know if you had any errors.
- **Daemon Status** – displays the current state of the background daemon.
- **Lock Status** – shows the current state of the lock. Restores as well as backups respect the lock status.

To view the Restoration menu, select E. The restore menu allows you to initiate restores of entire virtual machines, single VMDK files, and individual VMX files.



The first level of the restore menu lets you select how you want to perform the restore.

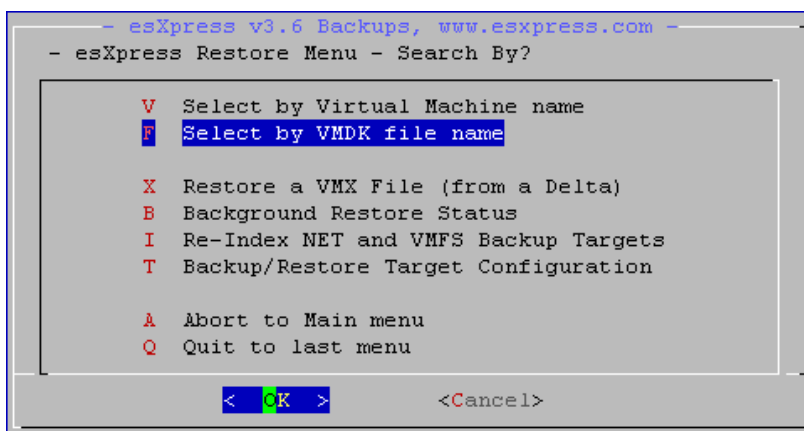
The following table describes each restore menu option.

Table 2 - Restore Menu Options

Menu Option	Description
C	Restore through the ESX Console. Initiates the esXpress Restore process.
X	VMX Restore through the ESX Console. Restores only a VMX file.
B	Background Restore Status. Shows the current status of all background restores for that host.
R	Replication Actions. Shows the replication menu.
L	BG Lock Status. Manage the restore locks.
T	Tail esXpress Log. View the esXpress backup log.
I	Re-Index NET and VMFS Backup Targets. Re-index backup targets.
S	Create a STUB File for an existing VMDK. Creates a VMDK Stub file.
H	Help on Restores. View the esXpress Restore Readme.
A	Abort to the Main menu.
Q	Quit to Main menu.

- To restore through the console, select **C Restore through the ESX Console**. If the local database has not been updated within the previous 15 minutes, esXpress will re-index your backup targets to ensure the restore process has the most current backup information.

The next menu lets you select what you want to restore.



The following table describes the options available.

Table 3 - Restore Menu - Search by options

Menu Option	Description
V	Select by Virtual Machine name. Restores the selected VM and optionally registers it to the host.
F	Select by VMDK file name. Restore just the selected VMDK file.
X	Restore a VMX file (from a Delta). Restore a VMX file only.
B	Background Restore Status. Shows the current and complete status of all background restores for the host.
I	Re-index NET and VMFS Backup Targets.
T	Back/Restore Target Configuration options.
A	Abort to Main menu.
Q	Quit to last menu.

Selecting either option **V** to restore an entire VM or option **F** to restore only a VMDK will both display a list of available backups. Option **V** will additionally prompt you to register the VM.

The list of backups may be very large. You can use the Search and Filter options to locate a particular VM.

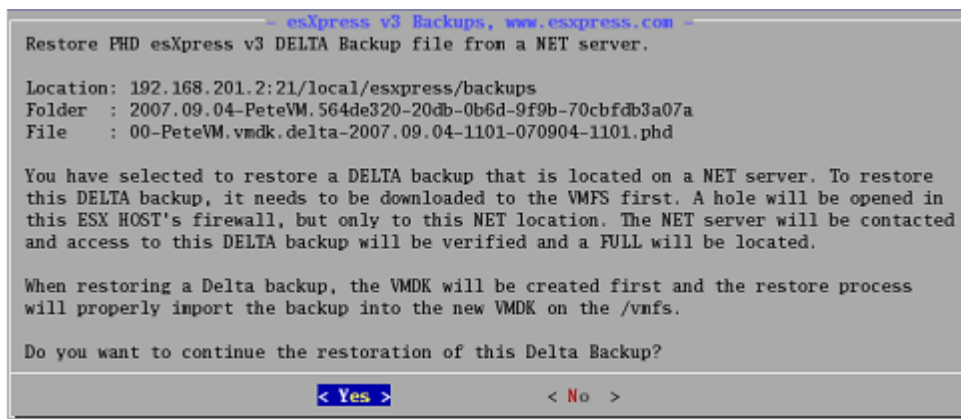
- When you've located the backup you want to restore, select it and then select OK. The system will display a listing of the dates for which archives are available for the selected virtual machine. Or you can select **Show All Backups** to have the system display all archives available for this virtual machine.

Whether you selected a particular date or all dates, the system will next display all archives available from all defined restoration locations, including fail over hosts. If esXpress is configured to backup to multiple locations, you may have duplicate entries for the selected virtual machine.

- At this point you are ready to select the archive file you want to restore, either a Delta or Full archive. When restoring a Delta archive the restore process will also automatically locate the associated Full archive. The second column describes where the particular archive is located. If an archive is stored

in two or more locations, select the location that is nearest to you (local FTP vs. FTP over the WAN, or VMFS vs. remote SSH). This can have a dramatic effect on the restoration speed.

In the figure below, we have selected to restore a Delta Archive from a network backup target which is an FTP server. A confirmation screen is presented. Make sure to review your selection carefully before selecting **Yes** to continue.



- Once you have confirmed this is the correct virtual machine and archive date, the system will ask you to select which FULL archive to restore from, if there are multiple archives available. Again, remember to select the archive that is most local to your location.

For restorations where you are restoring to the virtual machine's original location (or current location if over writing), and restoring with the original VMDK file names, you need to do nothing more than select **Original Location**, then select **OK** or **Yes** through the remaining restoration menus, accepting the defaults.

By selecting **Other Location** the system will prompt you to select a VMFS volume and directory, or optionally create a new directory. The menu in allows you to select from all VMFS volumes presented to that particular host.

- Once you have selected the volume to restore to, you are prompted with a list of available subdirectories. If you are not restoring to an existing directory, select **Make New Folder** and follow the steps to create the new folder.
- After you have either created a new location, or selected an existing location, the system will ask you to confirm the VMDK name. You can change the name of the VMDK file here if necessary.

Note: If you are restoring to the current location, make sure that the VM is powered off. As a safety precaution, esXpress will not restore over a running VM.

- Review the restore information to ensure everything is correct and to continue with restoration of the selected virtual machine, select **Yes**.

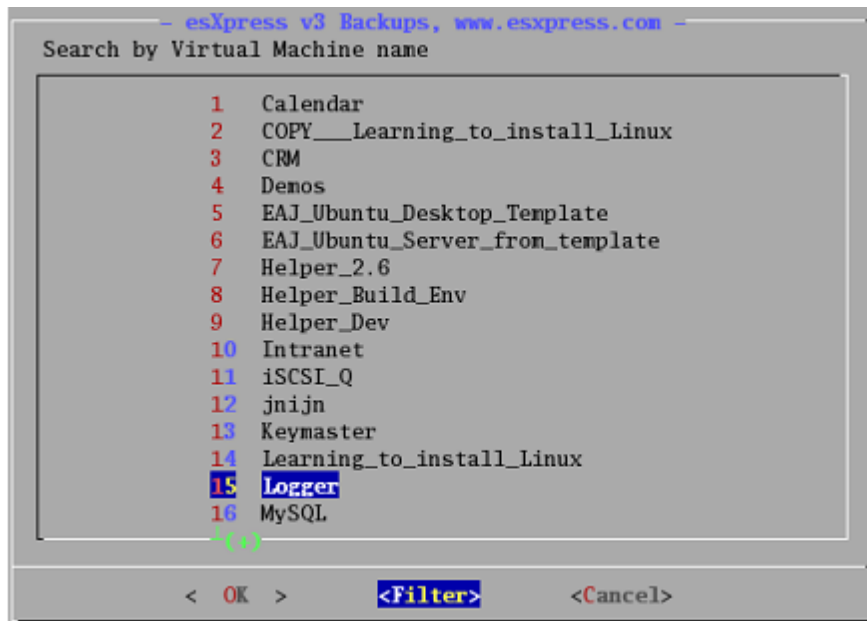
The esXpress restore engine has the ability to submit the restore job to the background. With this ability you can process multiple restores in the background, releasing your main session. The status of the background restore processes can be checked on the **Main Restore Menu**, under the **Background Restore Status Option**.

- Select whether or not to run the restore in the background or continue the restore in the foreground. If running the restore job in the foreground, the progress is displayed.
- After a successful restore, you will see the message, **Restore process complete**.

Note: If you restore to a different location then you must modify the Virtual Machine from the client to point the VMX to the new location. esXpress does not modify the VMX in this situation. Without doing this step, the VM will not power on with a 'File Not Found Error.'

Using the Filter

When searching for esXpress backup archives in environments with a large number of VMs it can become very tedious to page up and down through the Virtual Machine or VMDK search options to find your archive. The Filter feature makes this process much easier and can help you refine your search criteria to find the correct archive quickly.



To search using the filter, at the VM name window, select Filter. The Filter Menu opens.

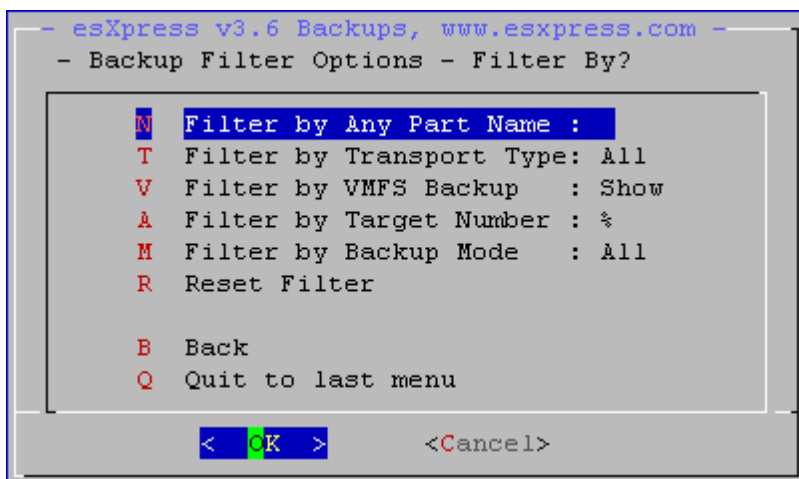


Table 4 - Filter Menu Options

Menu Option	Description
N	Filter by Any Part Name. This will open a dialog window allowing you to enter any partial name

Menu Option	Description
	to limit your search. For example, if you are looking for all VMs that contain “dev” in the name, enter dev in the text box and select OK.
T	Filter by Transport Type. Filters the list by network target transport types (ALL, SSH, or FTP).
V	Filter by VMFS Backup. There are three available VMFS filter options. Show – keeps your VMFS target in the search. Only – displays only VMFS archives. Hide – excludes VMFS archives from the search.
A	Filter by Target Number. Filter by the backup target number (1 through 9) or set it to % which will search across all targets.
M	...Filter by Backup Mode. Search for All backups, or limit to just PHDD, Fulls or Deltas.
R	Reset Filter. Removes all filter options.
B	Back. Returns to the list of VMs and applies the filter.
Q	Quit to last menu. Returns to the last menu without applying filters.

The Filter menu will display the current filters you have defined. Click **Back** to show the filtered list of VMs.

Checking Background Restore Status

If you've selected to run restores in the background, you can check the status of any restore job running using the Restore menu.

To check background restore status

1. Launch the PHD text menu from the host service console (log in to the host device and type **phd** on the command line and hit **Enter**).
2. Select **E - Restoration Menu**.
3. Select **B - Background Restore Status**. The next menu displays all running background restore jobs. If multiple jobs were designated to run in the background, you will need to first select the job from the list available.
4. Select the background restore job and select **OK** to show the status page for the individual job. Alternatively, you can select **Log** to view the log in progress. To exit, hit CTRL-x. The following table describes the restore status options.

Table 5 - Restore Status Menu Options

Menu Option	Description
[#]	The numbers at the top of the menu list all restore jobs that were designated to run in the background.
L	Use the BG Lock Status options to set and clear locks on restore jobs running in the

Menu Option	Description
	background.
D	Use this option to clear old background restore logs you no longer need. This will remove all logs that have completed, whether they ended successfully or in error.
R	Use this option if you need to cancel and remove a pending background restore job.
A	Return to the main menu.
Q	Quit to the last menu.

Restore Queue Readme

When esXpress does a restore, it can do it a number of ways. When you use the PHD menu to restore a VMDK, you have the option to submit it to the restore queue. When you choose a Delta backup to restore, at the end you have the option of submitting it to the restore queue or you can run it in the foreground.

(Always restore Delta backups over a Full backup. Restoring a Full might be faster, but when you restore a Delta backup it has many advantages. The VMDK will be pre-allocated and the backup imported into the VMDK. Each block of the Full and the Delta are compared against the index map to validate the checksum of all data. esXpress knows the proper name of the VMDK to restore.)

In the phd text menu, option (C) Replication / Restore Options menu under the (C) Configuration menu has the options for the restore queue.

- It needs to be enabled, it is by default.
- You can configure how many concurrent restore jobs to run at once.

The default is 1, with a max of 4. Do not run 4 unless you increase the MHZ reserved for the console.

The restore queue is `/etc/phd/restore`. When backups are submitted for restore, a control file is created in this folder, then the `phd_daemon` will pick it up, and run the restore. If you define 2 restores to run, then 2 will run at a time. The log for each restore is also kept in this folder. From the Replication menu you have the option to clean up and delete the restore jobs. (auto purging coming)

(Running 2 in a normal console is OK, but increasing console CPU Mhz will help keep the console from bogging down. Do not run more than 2 unless you increase the CPU allocation. But do experiment and test.)

From the (B) Backup Restore Status menu you can see the restore queue. It shows all the restore jobs in the `/etc/phd/restore` folder. The restore status for each is shown if it is complete, or Waiting to run. For each restore you can see who submitted the restore job, along with the log for each. If the restore is currently running you can watch the log as it runs. Remember to hit ^C (Control C) to exit the live viewer. When a backup is complete you can also view the log, this will use nano or vi.

The restore queue is only for Delta archive restores. It will not work for a Full backup.

Automatic Mass Restore

The Automatic Mass Restores allow you to restore many VMDKs easily. This is very helpful during a disaster recovery situation; by restoring a group of VMDKs automatically, esXpress turns mass restores into simple replication.

Note: The mass restore and replication features require a valid support contract.

Performing mass restores requires you to provide a list of VMDKs to restore and the name of the VMFS to restore to. Using the PHD menu, the VMDK files are checked against your backup targets (FTP servers, for example) and the backup files that meet the criteria are restored.

Note: Backups are matched by name, which may result in multiple matches, in which case only the first backup found is used. Be sure to test the process to ensure you are restoring the correct VMDK backups.

To restore a delta backup (which the mass restore uses) it must be downloaded to the local host, first. Then the delta backup is run like a program. The delta backup will pull the Full backup from the FTP server and create a new VMDK file. The backup is imported into the VMDK (by creating or reusing the VMDK file). When complete, the delta backup file is deleted. Then the next VMDK file is processed and restored. This entire process is automatic; once the VMDK backups to be restored are defined, you're finished, esXpress takes care of the rest.

Restoring Your Datacenter in 10 Steps

1. Start by restoring your backups from tape to a server.
2. On this server, enable and configure the FTP service.
3. Install and configure the esXpress RPM on the ESX hosts.
4. Log in to the ESX host and from the PHD text menu, select option **E - Restoration Menu** then option **R - Replication Actions**.
5. Choose option **F - Load 'vmdks.auto' file** to import the VMDK list from an FTP server or other defined backup targets.
6. Choose option **E - edit 'vmdks.auto' Restore file** to view the VMDK list and select the VMs you want to restore.
7. Choose option **R - Run Replication Manually Now** to run the mass restore.
8. Choose option **B - Background Restore Status** to check the status of the restoration of your VMDK files.
9. Choose option **T - Tail esXpress Log** to view the esXpress log file to check the status of the restoration.
10. Repeat steps 3-9 for any other ESX hosts.
11. For each restored VM, create a VMX file on the host they were restored to.

Detailed information about each menu option is described within the section, "Replication" (on page 31).

Replication

esXpress can be configured to replicate VMs from one location to another once per day or as frequently as once per hour, if required.

Note: The mass restore and replication features require a valid support contract.

During replication, the complete VMDK backup is restored to a host or hosts automatically, on a scheduled basis. The default settings for replication are:

- The original VMDK filename is used.
- If the VMDK already exists, it is overwritten.
- It is not verified afterwards.

Replication must be enabled using the PHD text menu or the Management Appliance at the host level.

To enable replication using the PHD text menu

1. Log in to your host.
2. At a command prompt, type `phd` and hit **Enter** to open the text menu.
3. Select option **C Configuration Options**.
4. Select option **C Replication / Restore Options**.
5. Set **Enable_Auto_Replication** to **Yes**.
6. Use these options to set the replication schedule and the location to store replicated VMs. Additional replication host-level configuration options are explained in the esXpress Reference Manual.
7. Next you will need to load and edit the list of files you want to replicate to the host. See "[Replication Actions Menu](#)" (on page 31) for more information.

To enable replication using the Management Appliance

1. Open a browser and log in to the Management Appliance web page.
2. Click **Hosts** to show the list of your hosts and then click the name of the host for which you would like to enable replication.
3. Click the **Restoration** tab.
4. In the **Replication Options** area, select **Enable Replication**.
5. When you enable the option, additional options will become available. Use these to set the replication schedule and the location to store replicated VMs. Additional replication host-level configuration options are explained in the esXpress Management Appliance Guide.
6. Click **Save** and **Publish** your changes.
7. Next you will need to load and edit the list of files you want to replicate to the host. See "[Replication Actions Menu](#)" (on page 31) for more information.

Replication Actions Menu

All replication commands are handled using the Replication Action Menu. The menu is used on the Replicated to Host. To access the Replication Actions menu, from the Restore Menu, select **R -**

Replication Actions.

Note: The mass restore and replication features require a valid support contract.

```

- esXpress v3.6 Backups, www.esxpress.com -
- esXpress Replication Menu -

  Replication is - Disabled
  L BG Lock Status - Clear (Quorum Enabled)
  B Background Restore Status
  R Run Replication Manually Now
  T Tail esXpress Log
  -----
  E Edit 'vmdks.auto' Restore file
  F Load 'vmdks.auto' file VMDK names
  V View '/etc/phd/restored.log' File
  -----
  D Delete '/etc/phd/restored.log'
  A Abort to Main menu
  Q Quit

  <OK >      <Cancel>

```

The top line of the menu shows the current replication status, either Enabled or Disabled.

The following table describes the Replication Actions menu options.

Table 6 - Replication Actions Menu Options

Menu Option	Description
L	BG Lock Status. Shows the current background lock status. Similar to backups, restores also use lock files. Use this option to set or clear the restore locks. Restore locks are checked before a restore is started. It will not cancel a restore that is running.
B	Background Restore Status. View the status and logs of background restore jobs.
R	Run Replication Manually Now. Start replication manually. See "Running Replication Manually" (on page 33) .
T	Tail esXpress Log. View the current esXpress main log.
E	Edit 'vmdks.auto' Restore file. Edit the esXpress replication instructions file. See "Editing the vmdks Restore File" (on page 33)
F	Load 'vmdks.auto' file VMDK names. Load the replication file with distinct VMDK names from the host. See "Loading the vmdks File" (on page 33) .
V	View '/etc/phd/restored.log' File. View a list of VMDK files that have been restored through esXpress replication.
D	Delete '/etc/phd/restored.log'. Delete the restored.log file. This is the log file of all replicated VMDK files that have been restored. Deleting this file will then allow esXpress replication to start with no VMDK files marked as restores. If you are trying to restore a backup through replication that has already been restored, delete this file and you will then be able to restore that backup.
A	Abort to the main menu.

Menu Option	Description
Q	Quit the application.

Loading the vmdks File

When doing Mass Restores or Replication, the `/etc/phd/vmdks` file controls which VMDK files to restore and to what VMFS. By choosing option 'F' a list of all distinct VMDK filenames will be loaded into the vmdks file for you. After it is loaded, you can edit the file for the VMDKs you want restore.

To get the distinct names, the following SQL statement is run against the FTP server database.

```
select distinct vmdk_name from ftp_database;
```

At the end of the vmdks file, a list of VMDK filenames are appended. The name is based upon the backup files on the FTP servers. The appended lines are commented '#' out. Remove the '#' to use that VMDK. The VMFS name is defaulted only as `/vmfs/`, you must add the rest of the VMFS name.

```
# VMDK Name Import
# 0005-esxpressmui.vmdk|/vmfs/
# 0005-VisualStudio.vmdk|/vmfs/
# 1001-dft01.dsk|/vmfs/
# 1001-dft02.dsk|/vmfs/
# 1101-oraforms00.vmdk|/vmfs/
# 1101-Genrad.vmdk|/vmfs/
# 0006-snapshots.vmdk|/vmfs/
```

Editing the vmdks Restore File

The file, `/etc/phd/vmdks.auto`, contains the instructions for the esXpress Mass Restore/Replication engine. It contains the list of VMDK files that can be restored as well as the VMFS they should be restored to. It also contains variables that control the behavior of the restorations.

The variable **USE_DAYS** sets which day's backups you want to use. The default is zero or commented out (##). When set to zero or commented out, the most recent backup will be used. To set it to another day, use a negative value, for example: minus One (-1) will restore yesterday's backups and minus seven (-7) will only restore backups at least 7 days old.

When entering the VMDK filename to restore, use either `VMHBA-Filename.vmdk` or `Filename.vmdk` notation. Use the VMHBA number to distinguish between different backup files.

If the VMDK name has # in front of it, then it is commented out and will be ignored. Remove the leading # to enable a VMDK for restoration. After the VMDK name there is a pipe '|' followed by the name of the VMFS. Currently there cannot be any spaces used in the VMDK name or the VMFS name.

In the following example, `linux.vmdk` will be restored to the `/vmfs/LOCAL` file system. Each VMDK file can be restored to a different VMFS.

```
RESTORE:linux1|524dbdd3-1162-31c1-3441-02fccad0070|00|linux1.vmdk|/vmfs/LOCAL
```

By editing this list of VMDK filenames and making a list that you want to restore and where to restore to, you can easily restore large numbers of VMDK backups with little effort.

Running Replication Manually

After you have configured the vmdks files and run a test restore, you are ready to run a mass restore/replication. Before allowing the restores to run automatically, you should run the restore from the menu first.

Select **R Run Replication Manually Now** to begin the process. A confirmation dialog will open. Select **Yes** to continue. If the configuration file is found, the replication will begin .

Restoring a VM Using the Management Appliance

As of esXpress version 4.0, you can restore VMs using the Management Appliance web interface. Log in to the Management Appliance and click Restore Now to open the restore interface.

Use the options available to restore entire VMs or individual VMDK files. Refer to the esXpress Management Appliance Guide for additional details.

Advanced Restoration Options

When a restore is initiated for a DeDupe backup (whether it is a one time restore, mass restore, or during replication), depending on the restore settings and the current state of the VMDK, different methods are used by esXpress.

1. If you are restoring to the same location where the VMDK file exists and it has not changed since the last time it was restored (during replication, for example), an incremental restore is attempted first. Incremental restores write only the blocks that have changed between backups - since esXpress has already catalogued the VMDK, there is no need to read the VMDK again and re-create the catalog - the differences can be written over the existing VMDK. This is the fastest type of restore for DeDupe backups.
2. If an incremental restore cannot be completed because the existing VMDK has changed since it was last restored, if enabled, an In Place restore is attempted next. In Place restores read the existing VMDK and create a new catalog, this is then differenced with the backup file and the differences are written over the existing VMDK.
3. If neither an Incremental nor an In Place restore can be completed (because the VMDK does not exist or other conditions could not be met), esXpress will attempt a Quick restore, if enabled. Quick restores restore the VMDK by first creating an empty VMDK of null data, then writing only the blocks from the deduplicated backup that contain actual data. This method ensures data restored to the VMFS is not fragmented.
4. If none of these methods are available (if you're restoring to a local hard drive using the self-restore feature of an esXpress backup, or to another location that is not a VMFS) a regular Full restore is performed.

The following advanced restore options can be configured using the Management Appliance (or PHD text menu).

Enable Quick Restore - With a Quick restore, the null blocks are skipped during the restore process and only the actual data blocks are restored. (**Use_PHD_Quick_Restore** option in the Replication/Restore Configuration menu of the PHD the text menu).

Enable In Place Restores - If incremental restores are not available, In Place restores are attempted next. With an In Place restore, esXpress reads the existing disk and compares it to the backup file to be restored, then only the changed blocks are restored. (**Enable_In_Place_Restores** option in the Replication/Restore Configuration menu of the PHD the text menu).

Chapter 3 - Example Replication Scenarios

For additional details on replication, view the README file, RESTORES.txt found in /home/phd/bin on the host where esXpress is installed.

Example scenarios may include:

- Have your Exchange server replicated to another host. In case you need to recover a mailbox, it's a lot easier to bring up the replicated copy of your Exchange server on host only network and exmerge the users mailbox or public folders. Then move them back to the real Exchange VM and exmerge them back in.
- Have 2 different hosts replicating your main File share. Have host #1 restoring last night's backup, while host #2 is a week behind.

The following sections describe example replication scenarios in detail:

- ["Replication Example" \(on page 38\)](#)
- ["Complex Replication Example" \(on page 39\)](#)

Replication Example

The following example describes a simple one-to-many replication with one host two days behind.

1. Our example VMDK, email.vmdk, is backed up at 00:01 hours when the nightly backup runs on ESX01. It is completed before 01:00 hours.
2. On ESX02, at 01:01 hours, the FTP server is checked for new backups. It finds our example email.vmdk and it is then downloaded and restored to the local host.
3. On ESX03, we have configured **USE_DAYS** (in the vmdks file) variable to '-2'. Because of this, the newest backup on the FTP server is not used. By setting '-2' we are telling mass restore not to restore backups that are newer than two days ago. It will restore the latest backup that was made two days ago.
4. At 02:01 hours, ESX02 and ESX03 will both index and check the FTP servers for new backups. If none are found, then nothing is done. This happens every hour. If a mass restore (replication restore) is currently running, a new one will not start. Only one automatic restore will run at a time.
5. At 12:01 AM the VMDK, email.vmdk, is backed up again on ESX01.
6. At 13:01, ESX02 checks the FTP servers and find a new copy of email.vmdk and restores it.
7. At 13:01, ESX03 checks the FTP server again, but does nothing else, as it has already restored the latest backup from 2 days ago.

This process will continue until it is disabled.

Complex Replication Example

By copying backups from one backup server to another, whether it's in the local datacenter or across the world, you can achieve simple datacenter replication when using esXpress. The following example describes a complex, replication scenario.

- At Location #1, ESX farm #1 backs up to FTP Server #1.
- Hosts exist in farm #2 (also at Location #1) replicating VMDKs from FTP Server #1.
- At Location #2, the ESX hosts replicate from the FTP Server #1 across the WAN.
- Instead of having the hosts at Location #2 pulling the backups from FTP Server #1 across the WAN, FTP Server is replicated to Location #2. There are numerous ways to do this.
 - If the FTP server uses SAN you can use the SAN to replicate the backups from one location to another.
 - If the FTP server is Windows-based, you can use something as simple as RoboCopy to copy the backups from one location to another.
 - If the FTP servers are Linux- or UNIX-based, you can use rsync to replicate the backup servers.

Chapter 4 - Installing CYGWIN

With the CYGWIN environment installed on your Windows server you can restore backup files by executing them just like you can from within a Linux environment.

To begin, you will need the CYGWIN installation package which can be downloaded at <http://www.cygwin.com>.

To install CYGWIN

1. Create a folder named **cygwin** in the root of your C: drive and download the CYGWIN installer there.
2. In the new folder, double click setup.exe to launch the installer. The installation menu will open.
3. Select **Next** to continue. Next you are prompted to select a download source. These steps require access to the Internet.
4. When prompted to choose a download source, select **Install from Internet** and click **Next**.
5. Next, select the directory to install Cygwin, or accept the default selection. Ensure that **All Users** is selected in the **Install For** section and **Unix/binary** is selected in **Default Text File Type**
6. Next you are prompted for the Local Package Directory. Select the same directory as you did for the CYGWIN installation.
7. The next prompt requires you to specify how the application should connect to the Internet. Select the option that applies to your environment.
8. At this point you are prompted to Choose A Download Site. For the best download speeds, try to select a site that is located within your country or region.
9. The installation now requires you to select the desired packages. In addition to the default selections you will need to select additional packages for use with esXpress.
10. Scroll down until you find the section **Interpreters**. Expand the installation options.
11. Select the following interpreters: expat: XML parser library, gawk: GNU awk, and perl: Practical Extracting and Reporting Language.
12. Next scroll down until you find the **Net** section. From here, select **openssh** (**openssl** is automatically selected as well).
13. Scroll down and find the **Utils** section. Select **bzip2**, **cygutils**, and **gnupg**.
14. Scroll down to the **Web** section and select **lynx: Text-mode WWW browser**.
15. Select to install the CYGWIN icon and click **Finish**.
16. When the installation is complete, click **OK**.

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