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# Pano Express HA Architecture Redbook

Virtualized Desktops running a standard Windows operating system but hosted on centralized servers promises to radically reduce the ever-increasing drain on IT resources from deploying and supporting desktop computing. Pano Logic® is the first company to offer a complete, purpose-built solution for full native Windows® virtual desktops, combining a unique zero client endpoint with centralized management tools designed specifically for managing virtual desktops.

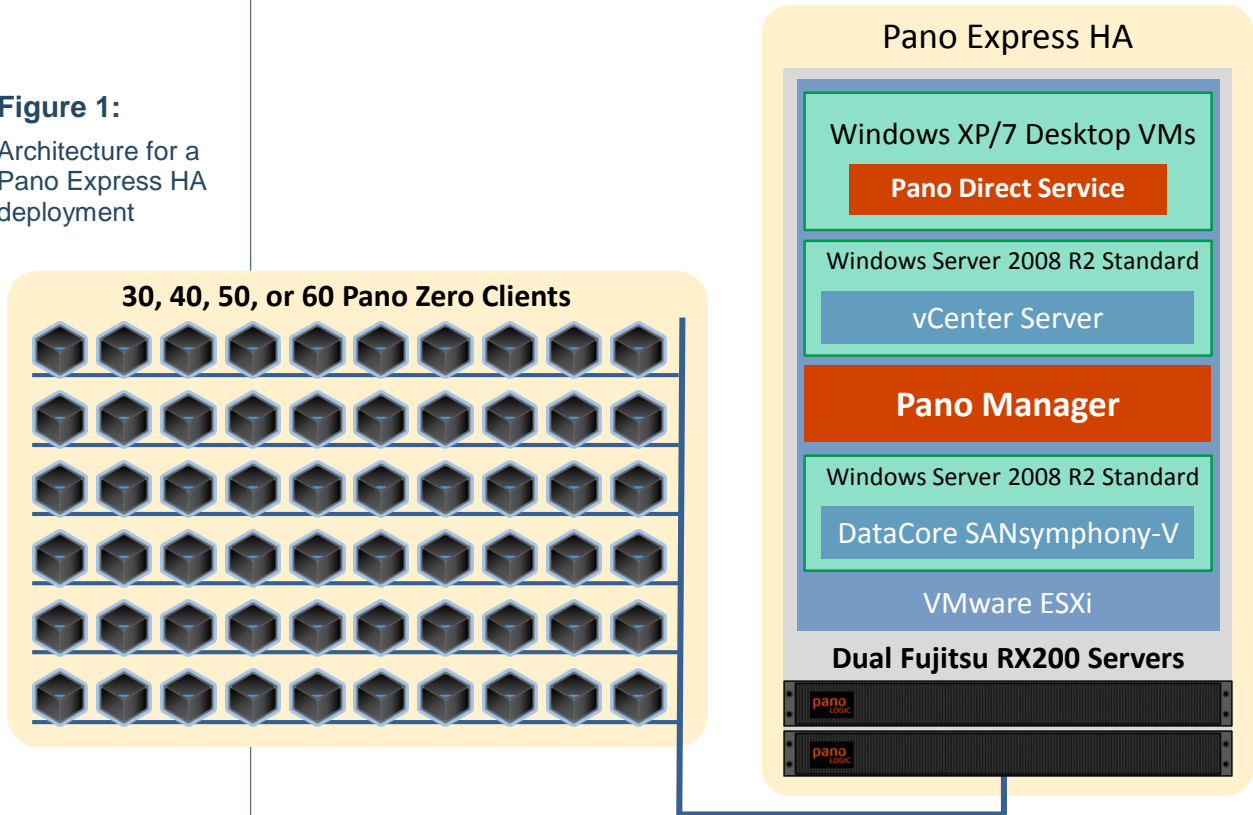
While many Pano Logic customers choose to configure and purchase server/storage infrastructure on their own, Pano Logic also provides the Pano Express HA (High Availability) solution to speed and simplify virtual desktop deployments. By providing a complete and preconfigured fault-tolerant infrastructure, Pano Express helps you deploy virtual desktops with fewer IT resources and less time by eliminating many planning, configuration and installation steps.

This redbook provides a detailed overview of Pano Express HA solution including architecture, server and storage hardware, software configuration and network requirements, followed by a detailed parts list. It provides sufficient detail on the Pano Express HA components to allow an equivalent Pano Zero Client solution to be configured by a knowledgeable Pano Logic channel partner, but with different hardware or software components.

Pano Logic redbooks assume readers have good familiarity with both their virtualization platform's operation and with the basic structure and operation of the Pano System. They are not intended to replace your platform vendor's documentation or the Pano Logic online help. This redbook is supplemented by the *Deployment Architecture Overview Redbook*, which provides more general deployment planning and sizing guidance, and the *Remote Deployments Redbook*, which provides more detailed information on network planning, sizing and troubleshooting.

This document describes the architecture and components for a 30- to 60-seat Pano Express HA (High Availability) deployment.

**Figure 1:**  
Architecture for a Pano Express HA deployment



The general architecture for Pano Express HA consists of dual redundant servers configured with VMware vSphere Essentials and Pano System 4.5, linked over the customer's LAN to 30 to 60 Pano Zero Clients.

The High Availability of Pano Express HA is achieved both by installing redundant copies and via the storage replication provided by DataCore SANsymphony-V storage hypervisor:

- Pano Manager – with a separate redundant instance on each server configured for fail-over operation.
- The four shared mirrored ESXi datastores that store the desktop virtual machines (DVMs) and the VMware vCenter virtual machines (VMs)

## Hardware Architecture

### SERVER ARCHITECTURE

Pano Express HA is deployed on dual identical servers with the following components:

- 1U Fujitsu RX200 chassis with 8 drive slots and no optical drive – this choice of chassis minimizes the rack space needed and provides enough drive slots to meet IOPS requirements.
- Dual six-core E5645 Intel CPUs for a total of 12 hyper-threaded cores.
- 72 GB ECC UDIMM unbuffered RAM configured symmetrically for both processors sharing a total of:
  - Six 4 GB UDIMMs for a total of 24 GB
  - Six 8 GB UDIMMs for a total of 48 GB

- Internal direct-attached storage system consisting of:
  - RAID Controller with 512MB Cache and Battery Backup
  - Seven internal 300 GB 10K rpm 2.5" SAS hard drives
- Two Ethernet expansion cards for a total of 8 ports including those on the motherboard (see Storage Network section below for more information)
- Dual redundant 460 watt power supplies – the server is able to operate on a single power supply if necessary.
- High performance 5 Gigabit network connection between the 2 servers used just for isolated HA heartbeat monitor, HA DataCore storage replication, etc.
- 4 GB dedicated internal flash storage for ESXi, set as the boot device.

Table 1 below provides an overview of the Pano Express HA zero client, server and storage hardware.

**Table 1: Summary of Hardware for a Pano Express HA**

Component	Amount	Description
Pano Express HA Server	2	Dual six-core Intel E5645 CPU and 72 GB RAM. Server hosts hypervisor software, Windows DVMs, Pano Manager, and platform DVM-management.
Storage – Direct-Attached, Internal to each Pano Express HA Server	Available Capacity: 1.48 TB	The system will have access to 1.48TB of useable shared storage for DVMs and vCenter
	Minimum IOPS: 1,260	From seven 15K RPM SAS drives as direct-attached storage internal to each server, configured as a single RAID5 volume.
Internal Storage Networking	6 connections	Cross-connections between the two servers using Ethernet cross-over cards and two 2- and 4-port Ethernet add-in cards in each server.
Pano Zero Clients	30, 40, 50, or 60	Pano zero client endpoints, black finish, for deployment on customer LAN.
<b>Provided by customer:</b>		
External Networking	1-2	1 Gbps/100 Mbps switch(es) for edge network
	4	Two 1 Gbps connections in the core network to each the two Pano Express HA servers.
Management Workstation	1	Windows workstation needed to initially configure the Pano Express HA server.

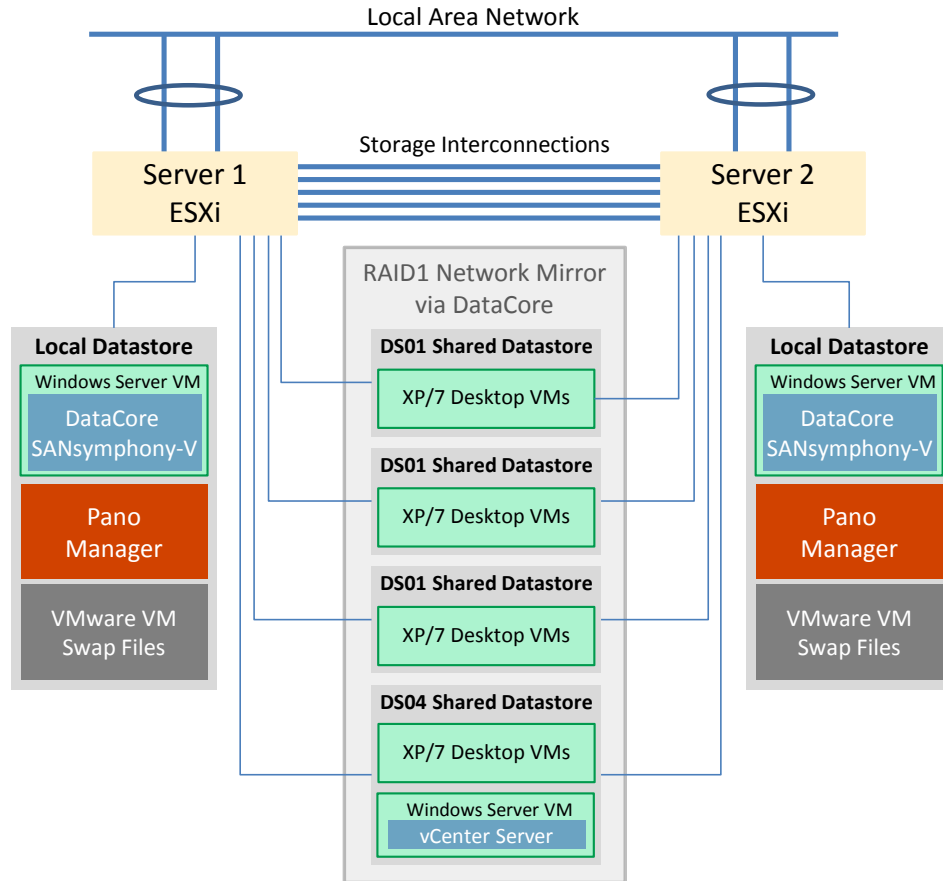
**STORAGE ARCHITECTURE**

The server storage hardware is designed for a simple, cost-effective deployment model that uses replication between each server’s direct-attached internal storage rather than shared storage like a NAS or SAN.

he internal storage in each server uses a RAID controller to both improve performance and to provide a level of fault tolerance:

- The RAID controller is configured (via the battery backup) to cache both reads and writes for optimum performance.

**Figure 2:**  
Pano Express HA  
datastores and  
network connections



#### DATASTORE ARCHITECTURE

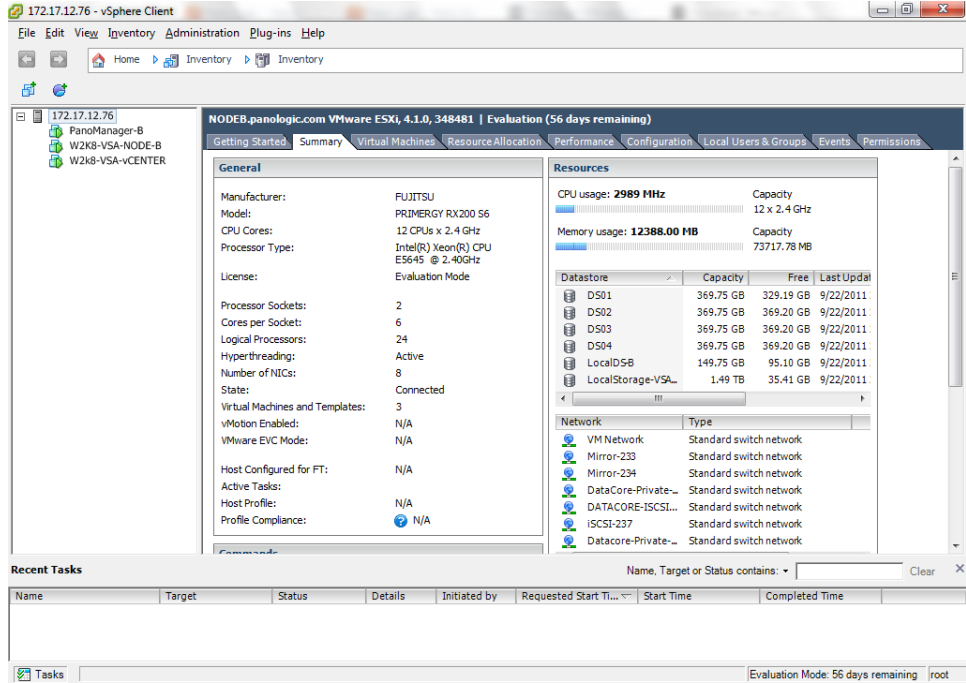
Inside the RAID5 volume on each server the following five ESX datastores are configured as shown in Figure 2:

- Four 370 GB shared datastores totaling 1.45 TB to hold the vCenter VM and desktop virtual machines (DVMs) called DS01-DS04. These shared datastores are linked in a RAID1 network mirror between the servers by the DataCore SANsymphony-V storage hypervisor.
- One 145 GB local datastore called LocalDSB on each server which hosts the local copy of Pano Manager VM, the C Drive for the DataCore VM and the VMware Swap Files for all of the virtual machines running on the server.

Each of the four mirrored datastores (DS01 – DS04) should be allocated no more than 15 active s. The DS04 shared datastore also contains the vCenter Server VM.

**Figure 3:**  
vSphere Client showing the Pano Express HA datastores

Figure 3 shows the local LocalDSB and DS01-04 shared datastores listed in the vSphere Client's Summary tab.



**STORAGE NETWORK CONFIGURATION**

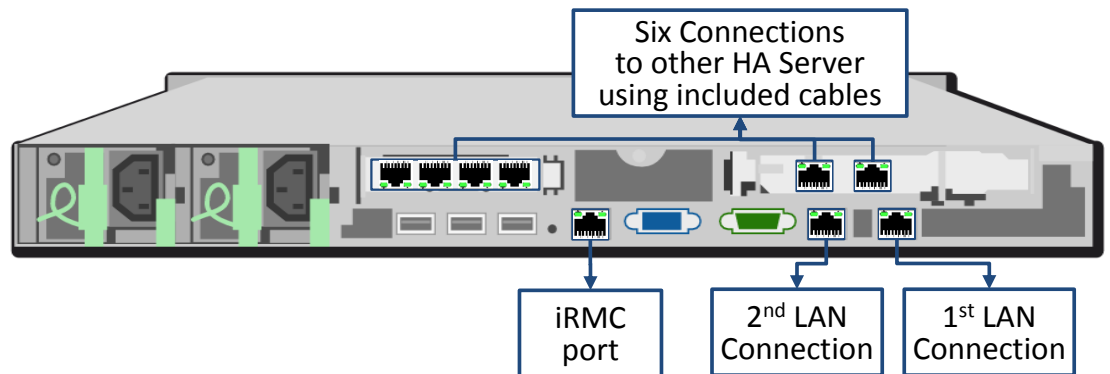
To provide a separate network used for the DataCore SANsymphony™-V storage hypervisor, each server is connected to the other with a total of six direct Gigabit Ethernet connections.

Each Pano Express HA server uses an added set of Gigabit Ethernet expansion cards:

- Two Ethernet expansion cards for a total of 8 ports including those on the motherboard:
  - A four port Gigabit Ethernet card
  - A dual port Gigabit Ethernet card
- Six Ethernet cross-over cables (length 6") cables included with the servers.

Using six ports from these two add-in cards along with the two ports on the server's motherboard, the Pano Express HA servers are connected to each other and to the customer's LAN switches as shown in Figure 4 below.

**Figure 4:**  
Pano Express HA server LAN and storage networking interconnections



This storage network runs entirely separately from the customer's LAN with its own statically assigned IP addresses and using a Windows Workgroup called DATACORE and the iSCSI protocol for internal communications. Storage traffic directed over these six Gigabit links is used to mirror the shared ESXi datastores between the two servers.

The private static IP ranges used should be checked for potential conflicts with the customer's network – the IP address ranges used by the internal storage network are:

- 192.168.233.0/24
- 192.168.234.0/24
- 192.168.235.0/24
- 192.168.236.0/24
- 192.168.237.0/24
- 192.168.238.0/24

The customer's LAN can't be using any of these static IP address ranges or there may be a routing conflict with the vCenter VM.

## Software Architecture

### VMWARE CONFIGURATION

Pano Express HA uses the very cost-effective VMware vSphere 4 Essentials package which includes the VMware ESXi hypervisor and VMware vCenter Server. vSphere Essentials is licensed for 3 hosts (maximum of 2 processors per host) and 192 GB vRAM entitlement, more than adequate for a 30- to 60-seat deployment.

The following system virtual machines (VMs) are run inside ESXi:

- vCenter is hosted inside a Windows Server Standard 2008 R2 virtual machine on a shared datastore mirrored between the servers – but there is only one active vCenter VM for each Pano Express HA deployment.
- Pano Manager is a self-contained appliance inside a Linux-based VM running on both servers inside the local datastore.

Since there only one copy of vCenter installed, to recover in the event the server hosting vCenter fails the admin will need to manually re-add the vCenter VM to the inventory of the still working server and power it up.

Because the LAN IP addresses will vary between customer sites, the Windows Server VM hosting vCenter Server is left set to use DHCP initially. During the setup process a static IP address can be manually applied to the VM.

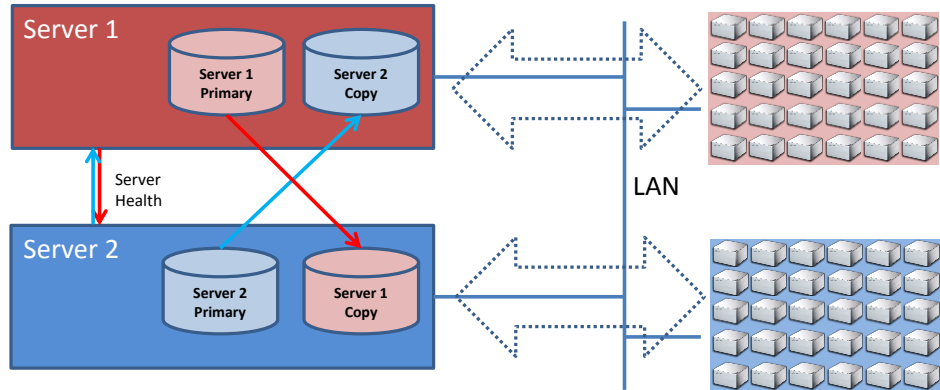
The ESXi host hypervisor on each server is also initially configured to use DHCP and can be left that way or optionally set to use a static IP number during the setup process.

### DATACORE CONFIGURATION

On each server a Windows Server 2008 R2 Standard edition VM is installed to hold the DataCore SANsymphony-V storage hypervisor software that functions as a storage virtual appliance.

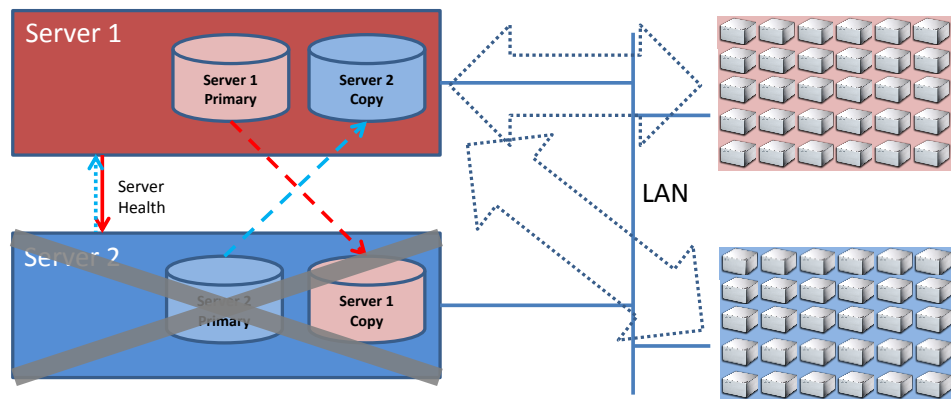
During normal operations, each Pano Express HA server services one-half of the Pano population, keeping a primary copy of these DVMs in its datastores. The SANsymphony-V VM in each server manages a RAID1 network mirror of the shared datastores that also includes a copy of the other server's DVMs as shown in Figure 5 on the next page.

**Figure 5:**  
Pano Express HA normal operation



If one server fails, the remaining server uses the mirrored copies of the failed server's DVMs to service the entire population of Pano users as shown in Figure 6.

**Figure 6:**  
Pano Express HA after server failure



In the event of a server failure, the mirrored DVMs from the failed server will need to be manually restarted from the Pano Manager running on the still working server.

Please refer to the DataCore documentation from [www.datacore.com](http://www.datacore.com) for more information on SANsymphony-V setup and configuration.

**PANO SYSTEM CONFIGURATION**

One instance of Pano Manager is run on each server to provide fault tolerance. Like the DataCore VMs, the Pano Manager appliances are on local datastores that are not shared between the two Pano Express HA servers.

As with the vCenter VM, Pano Manager is left set to use DHCP initially. During the setup process a static IP address should be applied to each of the two Pano Manager VMs.

A Pano Manager failover group is defined to link the two Pano Manager instances. This failover group initially uses a dynamic IP number assigned by the LAN's DHCP server but should be assigned its own static IP number. Please refer to [help.panologic.com](http://help.panologic.com) for more information.

**DVM ALLOCATION SIZINGS**

To support a broad range of user types and workloads on Windows 7 the server and storage hardware has been generously sized. You might be able to apply smaller allocations if running desktop VMs on Windows XP or if only supporting limited user workloads such as for task workers.

DVM allocations for a 60-seat Pano Express HA deployment spread across the two servers can be as high as:

- 2 vCPUs with a minimum of 800Mhz each
- 24 GB of HD space
- 2 GB of vRAM

## Appendix – Parts List

The table below lists the specific components included in the Pano Express HA solution.

**Table 2: Parts List for Pano Express HA**

Vendor	Part Number	Description	Qty
Fujitsu	S26361-K1342-V201	PY RX200 S6, 8HD-bays 2.5" Server Chassis	2
	S26361-F4485-E240	Intel Xeon E5645 6C/12T 2.40 GHz 12 MB CPU	4
	S26361-F3284-E2	Performance Mode Installation	2
	S26361-F3604-E535	SP 24GB 3x8 DDR3 1333 MHz PC3-10600 RDIMM ECC RAM	6
	S26361-F4482-E130	Hard Drive SAS 6G 300GB 10K HOT PL 2.5" EP	14
	S26361-F3554-E512	RAID Controller SAS 6G 5/6 512MB Cache	2
	S26361-F3257-E155	RAID Controller BBU Upgrade for RAID 5/6 V55	2
	S26361-F3610-E202	Ethernet Controller 2x1Gbit PCIe x4 D2735-2 Cu Low Profile	2
	S26361-F3611-E201	Ethernet Controller 4x1Gbit PCIe x4 D2745 Cu Low Profile	2
	S26361-F2735-E8	1U cable arm, dragged	2
	S26361-F2735-E101	RMK-F1_1-2U Server	2
	S26361-F1790-E241	iRMC S2 advanced pack	2
	S26361-F2341-E431	VMware ESXi 4.1 Embedded UFM Device (4 GB)	2
	S26113-F570-E1	Power Supply Module 450W Gold HP	4
Pano Logic	PANO-PAC-102-NA	Pano System Package — North America (G2) — Black Finish	30-60
	PANO-PSS-001	Premium Standard Support & Maintenance Subscription (1 Year)	30-60
DataCore	VPL-EWR-100-BSV	DataCore SANsymphony-V Pano Logic License (1 Node)	2
	VPL-EWR-TGD-BSV	DataCore SANsymphony-V 3 years support - Pano Logic License (1 Node)	2
VMware	n/a	vSphere 4 Essentials— includes the ESXi hypervisor and vCenter Server (licensed for 3 hosts)	1
	n/a	vSphere 4 Essentials Support – 3 years of 12x5 phone support and software updates	1
Microsoft	n/a	Windows Server 2008 R2 Standard (used to host vCenter Server and DataCore SANsymphony-V VMs)	3

## More Information

For information on setting up and managing the Pano System and Pano Express HA, consult the online help available at [help.panologic.com](http://help.panologic.com) and the support knowledgebase in the Pano Logic Customer Center at [support.panologic.com](http://support.panologic.com).

Detail information and help for Pano Express HA is available:

- Product information and technical specifications on the **Pano Express HA Data Sheet** at [www.panologic.com/datasheet/pano-express-ha](http://www.panologic.com/datasheet/pano-express-ha)
- Installation help from the **Pano Express HA Installation Checklist** at [www.panologic.com/pano-express-ha-checklist](http://www.panologic.com/pano-express-ha-checklist)
- Detailed network, peripheral, and power requirements on the **Pano Express HA System Requirements page** at [www.panologic.com/pano-express-ha-requirements](http://www.panologic.com/pano-express-ha-requirements)
- Technical support details on the **Pano Express HA Support and Maintenance page** at [www.panologic.com/pano-express-ha-support-maintenance](http://www.panologic.com/pano-express-ha-support-maintenance)
- More information on **DataCore's SANsymphony-V storage hypervisor** at [www.datacore.com](http://www.datacore.com)

For more information on the Pano System, please visit [www.panologic.com](http://www.panologic.com) or call us at 650-454-8940.

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