

IBM BladeCenter HX5

IBM Redbooks Product Guide

The IBM® BladeCenter® HX5 server is a blade server based on the fifth generation of the Enterprise X-Architecture®, delivering innovation with enhanced scalability, reliability, and availability features to enable optimal performance for databases, enterprise applications, and virtualized environments.

The IBM BladeCenter HX5 supports up to two processors, using latest "EX" generation of Intel Xeon processor E7 family. Two HX5 servers can be connected together for a high-performance single image with four processors and up to 1 TB of RAM in a blade form factor. For applications that need to maximize available memory but that do not need four processors, a single HX5 server can be attached to a MAX5 memory expansion blade to form a single image with two processors and up to 1.25 TB of RAM. This level of processing and memory capacity is ideal for large-scale database or virtualization requirements.

Figure 1 shows the IBM BladeCenter HX5 in the three scalable configurations.



Figure 1. IBM BladeCenter HX5

Did you know

The new models of the HX5 now support up to twice the memory, up to 40% better performance and support for energy-efficient low-power DIMMs.

Locations of key components

Figure 2 shows the inside of the server and indicates key components.

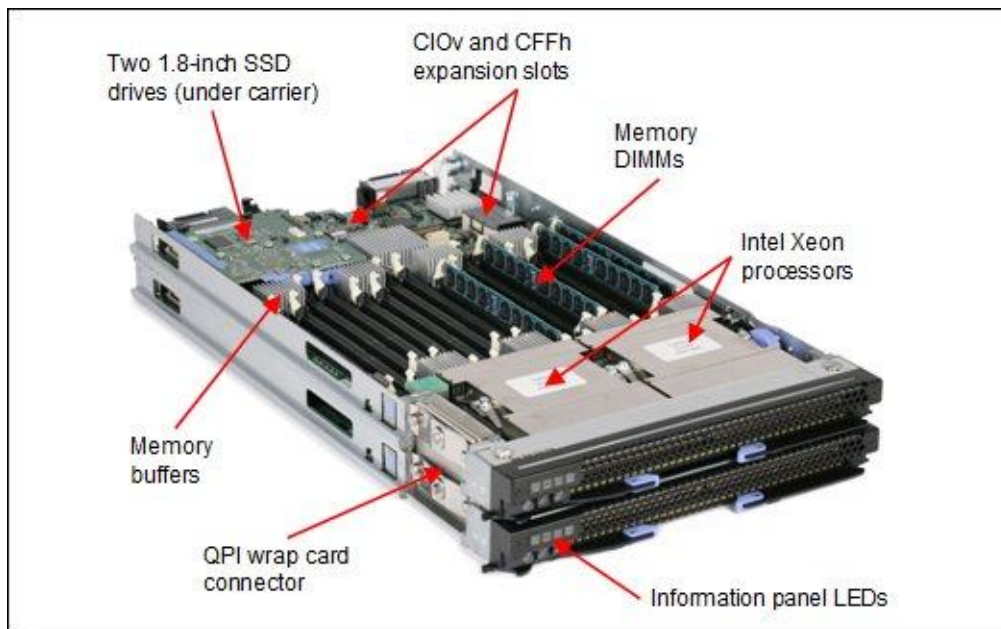


Figure 2. IBM BladeCenter HX5 (two nodes shown)

Figure 3 shows the internals of the MAX5 memory expansion blade. The MAX5 memory expansion blade is a device with the same dimensions as the HX5. When attached it adds an additional 24 DIMM sockets to the blade server.

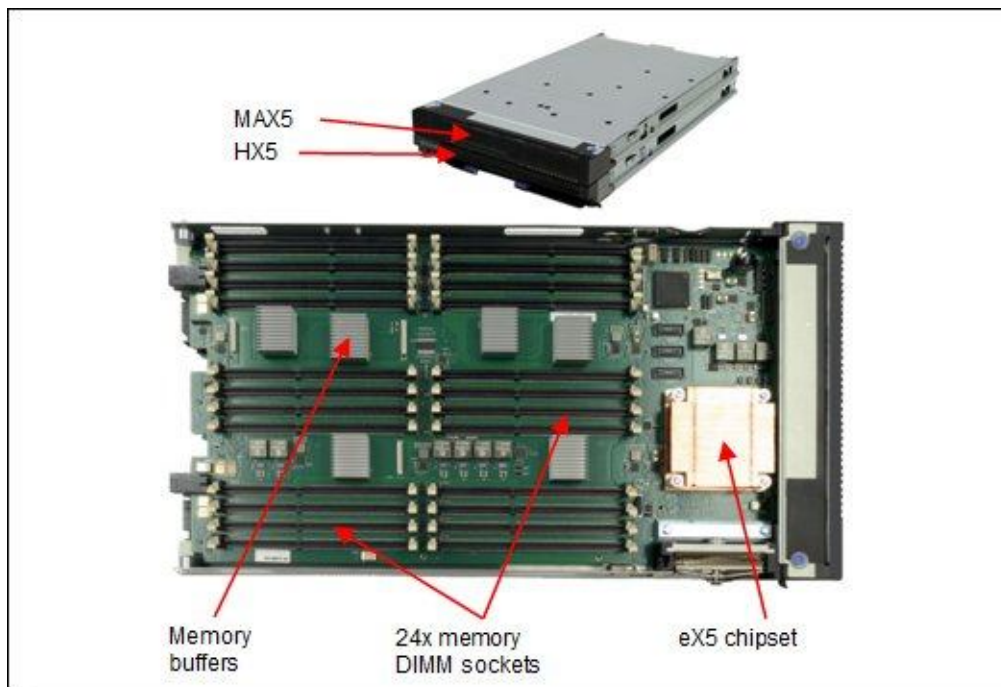


Figure 3. MAX5 memory expansion blade

Standard specifications

The following table lists the standard specifications.

Table 1. Standard specifications

Components	Specification
Form factor	Single node: 30 mm blade (single-wide) Two node: 60 mm blade (double-wide) Single node + MAX5: 60 mm blade (double-wide)
Processor (max)	Machine type 7873: Intel Xeon E7-8800, E7-4800, and E7-2800 families, up to 10 cores
Number of processors	Up to two processors per single-wide HX5; scalable to four processors
Cache (max)	Machine type 7873: Up to 30 MB per processor
Memory DIMM sockets	Single node: 16 DIMM sockets Two nodes: 32 DIMM sockets total Single node + MAX5: 40 DIMM sockets total (MAX5 adds 24 sockets.)
Memory (max)	Machine type 7873 supports the use of 32 GB DIMMs: <ul style="list-style-type: none"> • Single node: 512 GB • Two nodes: 1 TB • Single node + MAX5: 1.25 TB
I/O expansion slots	Single node: One CIOv connector (two ports) and one CFFh connector (four ports) Two nodes: Two CIOv connectors (two ports each) and two CFFh connectors (four ports each) Single node + MAX5: One CIOv connector and one CFFh connector (four ports)
Disk bays (total/hot swap)	Two non-hot-swap bays per single-wide HX5 - supporting solid-state drives
Maximum internal storage	Up to 800 GB of solid-state storage per single-wide HX5 (with 400 GB SSDs)
Network interface	Broadcom 5709S onboard NIC with dual Gigabit Ethernet ports with TOE Some models: Emulex Virtual Fabric 10Gb Expansion Card (CFFh)
RAID support	Optional RAID-0, -1, -1E
Systems management	Integrated systems management processor
OS support	Microsoft Windows, Red Hat Linux, SUSE Linux, VMware
Limited warranty	Three-year customer-replaceable unit and onsite limited warranty

The IBM BladeCenter HX5 is shipped with the following items:

- Documentation CD
- Statement of Limited Warranty
- Important Notices

Standard models

The HX5 is offered as machine type 7873 with Intel Xeon E7 processors.

As shown in Part 1 of the standard models table, some models optionally support the MAX5 memory expansion unit. If the MAX5 is attached you cannot also attach the two-node scalability kit to form a two-node configuration. The reverse is also true - forming a two-node configuration precludes the use of the MAX5. Models with E7-2800 series processors do not support forming a two-node configuration.

Table 2. Standard models - Machine type 7873 (Intel Xeon E7 processors) (Part 1)

Model	Intel Xeon Processor (2 maximum)	MAX5*	Two-node scale kit*	Std memory	Memory speed‡	Standard networking§	Storage	Drive bays
Base models with MAX5 optional								
7873-B1x	1x Xeon E7-4807 6C 1.86 GHz 18 MB 800 MHz	Opt	Opt	2x 4GB	800MHz	2x 1Gb	Opt	0 / 2
7873-B2x	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	Opt	Opt	2x 4GB	1066MHz	2x 1Gb	Opt	0 / 2
7873-B3U#	1x Xeon E7-4850 10C 2.00 GHz 24MB 1066 MHz	Opt	Opt	2x 8GB	1066MHz	2x 1Gb	Opt	0 / 2
7873-C1x	1x Xeon E7-8837 8C 2.67 GHz 24 MB 1066 MHz	Opt	Opt	2x 4GB	978MHz	2x 1Gb	Opt	0 / 2
7873-D1x	1x Xeon E7-8867L 10C 2.13 GHz 30 MB 1066 MHz	Opt	Opt	2x 4GB	1066MHz	2x 1Gb	Opt	0 / 2
7873-F1x	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	Opt	Opt	2x 4GB	1066MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-F2x	1x Xeon E7-4870 10C 2.40 GHz 30 MB 1066 MHz	Opt	Opt	2x 4GB	1066MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-H1x	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	Opt	Opt	2x 4GB	1066MHz	2x 1Gb + 2x 10Gb (E2)	Opt	0 / 2

* The HX5 supports either a MAX5 or the ability to expand to two nodes via the two-node scalability kit, however both of these are not supported at the same time. Some models have the MAX5 standard (88Y6128) and some models have the two-node scalability kit standard (46M6975).

Model B3U is available in the US only.

‡ With Xeon E7 processors, the memory speed in the HX5 and the MAX5 are the same.

§ All models contain an onboard 2-port Gigabit Ethernet controller. Some models also include an additional 10Gb Expansion Card installed in the CFFh expansion slot, as follows:

- (B) Broadcom 10Gb Gen2 2-port Ethernet Exp Card (CFFh)
- (E1) Emulex 10GbE Virtual Fabric Adapter Advanced
- (E2) Emulex 10GbE Virtual Fabric Adapter Advanced II
- (Q) QLogic 2-pt 10Gb Converged Network Adapter(CFFh)

As shown in Part 2 of Table 2, some models include the MAX5 standard. These models do not support the two-node scalability kit to form a two-node system since adding a MAX5 and adding a second node are mutually exclusive.

Table 2. Standard models - Machine type 7873 (Intel Xeon E7 processors) (Part 2)

Model	Intel Xeon Processor (2 maximum)	MAX5*	Two-node scale kit*	Std memory	Memory speed‡	Standard networking§	Storage	Drive bays
Base models with MAX5 standard								
7873-A1x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Std	No support	HX5: 4x 4GB MAX5: None	1066 MHz	2x 1Gb	Opt	0 / 2
7873-A2x	2x Xeon E7-2860 10C 2.26 GHz 24 MB 1066 MHz	Std	No support	HX5: 4x 4GB MAX5: None	1066 MHz	2x 1Gb	Opt	0 / 2
7873-A3x	2x Xeon E7-2870 10C 2.40 GHz 30 MB 1066 MHz	Std	No support	HX5: 4x 4GB MAX5: None	1066 MHz	2x 1Gb	Opt	0 / 2
7873-F3x	2x Xeon E7-4807 6C 1.86 GHz 18 MB 800 MHz	Std	No support	2x 4GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-G1x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Std	No support	HX5: 16x 8GB MAX5: 24x8GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-H2x	1x Xeon E7-4870 10C 2.40 GHz 30 MB 1066 MHz	Std	No support	HX5: 2x 4GB MAX5: None	1066 MHz	2x 1Gb + 2x 10Gb (E2)	Opt	0 / 2
7873-H3x	2x Xeon E7-4807 6C 1.86 GHz 18 MB 800 MHz	Std	No support	HX5: 4x 4GB MAX5: None	800 MHz	2x 1Gb + 2x 10Gb (E2)	Opt	0 / 2

* The HX5 supports either a MAX5 or the ability to expand to two nodes via the two-node scalability kit, however both of these are not supported at the same time. Some models have the MAX5 standard (88Y6128) and some models have the two-node scalability kit standard (46M6975).

‡ With Xeon E7 processors, the memory speed in the HX5 and the MAX5 are the same.

§ All models contain an onboard 2-port Gigabit Ethernet controller. Some models also include an additional 10Gb Expansion Card installed in the CFFh expansion slot, as follows:

- (B) Broadcom 10Gb Gen2 2-port Ethernet Exp Card (CFFh)
- (E1) Emulex 10GbE Virtual Fabric Adapter Advanced
- (E2) Emulex 10GbE Virtual Fabric Adapter Advanced II
- (Q) QLogic 2-pt 10Gb Converged Network Adapter(CFFh)

Part 3 of Table 2 lists the workload optimized models:

- Workload optimized models for database, with standard IBM BladeCenter PCIe Gen 2 Expansion Blade. Two IBM 320 GB High IOPS SD Class SSD PCIe Adapters (PCIe form factor) installed in the PCIe Gen 2 Expansion Blade. The models can also either have a MAX5 attached or can be joined to another HX5 to form a two node (but not both). See the I/O expansion options section in this document for details about the PCIe Gen 2 Expansion Blade.
- Workload optimized models for IBM BladeCenter Foundation for Cloud (optional or standard MAX5). The models are designed to be part of an IBM BladeCenter Foundation for Cloud configuration. IBM BladeCenter Foundation for Cloud provides a comprehensive, converged solution that brings together the hardware, software and services needed to quickly establish a robust virtualized environment. With the addition of select software, IBM BladeCenter Foundation for Cloud can easily be extended to a private cloud environment. For details about IBM BladeCenter Foundation for Cloud, go to: <http://ibm.com/systems/bladecenter/solutions/infrastructure/virtualization/integratedcloudplatform/>.

- Workload optimized models for zEnterprise BladeCenter Extension (zBX). These models can be installed in the IBM zEnterprise BladeCenter Extension (zBX) or within a traditional IBM BladeCenter chassis. These HX5 models are configured with Fibre Channel and Ethernet Networking options, making them easy to order, configure, and deploy.

Table 2. Standard models - Machine type 7873 (Intel Xeon E7 processors) (Part 3)

Model 7873-	Intel Xeon Processor (2 maximum)	MAX5*	Two-node scale kit*	Standard memory	Memory speed‡	Standard networking§	Storage	Drive bays
Workload optimized models for database - with standard IBM BladeCenter PCIe Gen 2 Expansion Blades								
G2x	2x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	Opt	Opt	8x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	2x 320GB PCIe SSD**	0 / 2
G4x	2x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	Opt	Opt	8x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E2)	2x 320GB PCIe SSD**	0 / 2
Workload optimized models for IBM BladeCenter Foundation for Cloud (optional or standard MAX5)								
91x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Opt	No support	16x 8GB	1066 MHz	2x 1Gb+ 2x 10Gb (E2)	Opt	0 / 2
92x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Opt	No support	16x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (Q)	Opt	0 / 2
93x	2x Xeon E7-8867L 10C 2.13 GHz 30 MB 1066 MHz	Std	No support	HX5: 16x 8GB MAX5: 24x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E2)	Opt	0 / 2
94x	2x Xeon E7-8867L 10C 2.13 GHz 30 MB 1066 MHz	Std	No support	HX5: 16x 8GB MAX5: 24x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (Q)	Opt	0 / 2
Workload optimized models for zEnterprise BladeCenter Extension (zBX)								
A4x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Opt	No support	8x 8 GB	1066 MHz	2x 1Gb + 2x 10Gb (B)+ 2x 8Gb FC	2x 50GB MLC SSD†	2 / 2
A5x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Opt	No support	16x 8 GB	1066 MHz	2x 1Gb + 2x 10Gb (B)+ 2x 8Gb FC	2x 50GB MLC SSD†	2 / 2
A6x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Opt	No support	8x 8 GB + 8x 16 GB	1066 MHz	2x 1Gb + 2x 10Gb (B)+ 2x 8Gb FC	2x 50GB MLC SSD†	2 / 2
A7x	2x Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz	Opt	No support	16x 16GB	1066 MHz	2x 1Gb + 2x 10Gb (B)+ 2x 8Gb FC	2x 50GB MLC SSD†	2 / 2

* The HX5 supports either a MAX5 or the ability to expand to two nodes via the two-node scalability kit, however both of these are not supported at the same time. Some models have the MAX5 standard (88Y6128) and some models have the two-node scalability kit standard (46M6975).

‡ With Xeon E7 processors, the memory speed in the HX5 and the MAX5 are the same.

§ All models contain an onboard 2-port Gigabit Ethernet controller. Some models also include an additional 10Gb Expansion Card installed in the CFFh expansion slot, as follows:

- (B) Broadcom 10Gb Gen2 2-port Ethernet Exp Card (CFFh)
- (E1) Emulex 10GbE Virtual Fabric Adapter Advanced
- (E2) Emulex 10GbE Virtual Fabric Adapter Advanced II
- (Q) QLogic 2-pt 10Gb Converged Network Adapter(CFFh)
- Models 7873-A4x, A5x, A6x and A7x also include a QLogic 8Gb Fibre Channel Expansion Card (CIOv)

** Model 7873-G2x and G3x include the 30 mm IBM BladeCenter PCIe Gen 2 Expansion Blade. The combined server is 60 mm wide (double-wide) and occupies two blade bays in the chassis. The Expansion Blade contains two IBM 320GB High IOPS SD Class SSD PCIe Adapters.

† Models 7873-A4x, A5x, A6x and A7x include two IBM 50GB SATA 1.8" MLC solid-state drives (SSDs) plus the SSD Expansion Card for IBM BladeCenter HX5.

As shown in Part 4 of the standard models table, some models are designed to be used in a two-node configuration. For these models, order one model with the two-node scalability kit and order one model with the same processor without the scalability kit. For example, order model 7873-BAx and 7873-BHx together. These models do not support the use of a MAX5.

Table 2. Standard models - Machine type 7873 (Intel Xeon E7 processors) (Part 4)

Model 7873-	Intel Xeon Processor (2 maximum)	MAX5*	Two-node scale kit*	Standard memory	Memory speed‡	Standard Networking§	Storage	Drive bays
Models for two-node configurations								
7873-BHx	1x Xeon E7-4807 6C 1.86 GHz 18 MB 800 MHz	No support	Std	2x 4GB	800 MHz	2x 1Gb	Opt	0 / 2
7873-BAx	1x Xeon E7-4807 6C 1.86 GHz 18 MB 800 MHz	No support	Connect to BHx	2x 4GB	800 MHz	2x 1Gb	Opt	0 / 2
7873-BJx	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	No support	Std	2x 4GB	1066 MHz	2x 1Gb	Opt	0 / 2
7873-BBx	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	No support	Connect to BJx	2x 4GB	1066 MHz	2x 1Gb	Opt	0 / 2
7873-CHx	1x Xeon E7-8837 8C 2.67 GHz 24 MB 1066 MHz	No support	Std	2x 4GB	978 MHz	2x 1Gb	Opt	0 / 2
7873-CAx	1x Xeon E7-8837 8C 2.67 GHz 24 MB 1066 MHz	No support	Connect to CHx	2x 4GB	978 MHz	2x 1Gb	Opt	0 / 2
7873-DHx	1x Xeon E7-8867L 10C 2.13 GHz 30 MB 1066 MHz	No support	Std	2x 4GB	1066 MHz	2x 1Gb	Opt	0 / 2
7873-DAx	1x Xeon E7-8867L 10C 2.13 GHz 30 MB 1066 MHz	No support	Connect to DHx	2x 4GB	1066 MHz	2x 1Gb	Opt	0 / 2
7873-FHx	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	No support	Std	2x 4GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-FAx	1x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz	No support	Connect to FHx	2x 4GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-FJx	1x Xeon E7-4870 10C 2.40 GHz 30 MB 1066 MHz	No support	Std	2x 4GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
7873-FBx	1x Xeon E7-4870 10C 2.40 GHz 30 MB 1066 MHz	No support	Connect to FJx	2x 4GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2

* The HX5 supports either a MAX5 or the ability to expand to two nodes via the two-node scalability kit, however both of these are not supported at the same time. Models as listed in Part 4 have the two-node scalability kit standard (46M6975).

‡ With Xeon E7 processors, the memory speed in the HX5 and the MAX5 are the same.

§ All models contain an onboard 2-port Gigabit Ethernet controller. Some models also include an additional 10Gb Expansion Card installed in the CFFh expansion slot, as follows:

- (B) Broadcom 10Gb Gen2 2-port Ethernet Exp Card (CFFh)
- (E1) Emulex 10GbE Virtual Fabric Adapter Advanced
- (E2) Emulex 10GbE Virtual Fabric Adapter Advanced II
- (Q) QLogic 2-pt 10Gb Converged Network Adapter(CFFh)

Express Models

The following table lists the region-specific Express models. Express models are preconfigured with additional components such as processors and memory to make the ordering and installation process simpler.

- Models with optional MAX5. These models can optionally attach to the MAX5 memory expansion unit. If the MAX5 is attached you cannot also attach the two-node scalability kit to form a two-node configuration. The reverse is also true - forming a two-node configuration precludes the use of the MAX5.
- Models with standard MAX5. These models do not support the two-node scalability kit to form a two-node system since adding a MAX5 and adding a second node are mutually exclusive.

Table 3. Express models - Machine type 7873 (Intel Xeon E7 processors)

Model 7873-	Intel Xeon Processor (2 maximum)	MAX5*	Two-node scale kit*	Standard memory	Memory speed‡	Standard Networking§	Storage	Drive bays
Models with optional MAX5								
E1x	2x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz 105w	Opt	Opt	16x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
E3x	2x Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz 105w	Opt	Opt	16x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E2)	Opt	0 / 2
Models with standard MAX5								
E2x	2x Xeon E7-2860 10C 2.26 GHz 24 MB 1066 MHz 130w	Std	No support	HX5: 16x 8GB MAX5: 8x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E1)	Opt	0 / 2
E4x	2x Xeon E7-2860 10C 2.26 GHz 24 MB 1066 MHz 130w	Std	No support	HX5: 16x 8GB MAX5: 8x 8GB	1066 MHz	2x 1Gb + 2x 10Gb (E2)	Opt	0 / 2

* The HX5 supports either a MAX5 or the ability to expand to two nodes via the two-node scalability kit, however both of these are not supported at the same time. Some models have the MAX5 standard (88Y6128) and some models have the two-node scalability kit standard (46M6975).

‡ With Xeon E7 processors, the memory speed in the HX5 and the MAX5 are the same.

§ All models contain an onboard 2-port Gigabit Ethernet controller. Some models also include an additional 10Gb Expansion Card installed in the CFFh expansion slot, as follows:

- (E1) Emulex 10GbE Virtual Fabric Adapter Advanced
- (E2) Emulex 10GbE Virtual Fabric Adapter Advanced II

Two-node and MAX5 scaling

The HX5 supports the following scalable configurations:

- A single HX5 server with two processor sockets. This configuration is sometimes referred to as a single-node server. In this configuration, install the IBM HX5 1-Node Speed Burst Card, 59Y5889, for maximum performance.
- A single HX5 server with a single MAX5 memory expansion blade attached. This configuration is sometimes referred to as a memory-expanded server. The server and MAX5 are connected together using the IBM HX5 MAX5 1-node Scalability Kit, 59Y5877.
- Two HX5 servers connected together to form a single image four-socket server. This configuration is sometimes referred to as a two-node server. The two servers are connected together using the IBM HX5 2-Node Scalability Kit, 46M6975.

Options for scaling the HX5 MAX5 model are shown in the following table.

Table 4. Options needed for MAX5 scaling

Part number	Description	HX5 7873	Maximum quantity supported
46M6973	IBM MAX5 for BladeCenter	Supported	1
88Y6128	IBM MAX5 V2 for BladeCenter	Supported	1
59Y5877	IBM HX5 MAX5 1-node Scalability Kit. Used to connect the HX5 to a MAX5.	Supported	1

The following table lists the two-node scalability options. These options are mutually exclusive. You cannot have a two-node configuration with MAX5 also attached.

Table 5. Options needed for two-node scaling

Part number	Description	Maximum quantity supported
59Y5889	IBM HX5 1-Node Speed Burst Card. Used when the server is not in a two-node or MAX5 configuration.	1
46M6975	IBM HX5 2-Node Scalability Kit: Used to connect two HX5 servers together (without MAX5 units).	1

Chassis support

The HX5 is supported in BladeCenter chassis S, H, and HT, as listed in the following table.

Table 6. Chassis support

Description	BC-E (8677)	BC-S (8886)	BC-H (8852)	BC-HT AC (8750)	BC-HT DC (8740)
HX5 server (1 node and 2 nodes)	No	Yes	Yes*	Yes	No†
HX5+MAX5 server	No	Yes	Yes*	Yes	No†

* HX5 configurations with 130 W processors require that the BladeCenter H has Enhanced Cooling Modules installed (Table 7).

† Support for the BC-HT DC model can be granted for specific configurations via the SPORE process.

The number of HX5 servers supported in each chassis depends on the thermal design power of the processors used in the HX5 servers (Table 7), which uses the following conventions:

- A green square in a cell means that the chassis can be filled with HX5 blade servers up to the maximum number of blade bays in the chassis (for example, 14 blades in the BladeCenter H).
- A yellow square in a cell means that the maximum number of HX5 blades that the chassis can hold is fewer than the total available blade bays (for example, 12 in a BladeCenter H). *All other bays must remain empty.* Empty bays must be distributed evenly between the two power domains of the chassis (for BladeCenter H, bays 1 - 6 and bays 7 - 14).

Table 7. Chassis support (detailed)

Server	Thermal design power (TDP) of the CPUs	Maximum number of servers supported in each chassis						
		BC-S (8886) (6 bays)	BC-H (models other than 4Tx) (14 bays)				BC-H (-4Tx) (14 bays)	BC-HT AC (8750) (12 bays)
			2900 W supplies		2980 W supplies*		2980W	
			Standard blowers	Enhanced blowers†	Standard blowers	Enhanced blowers†	Enhanced blowers†	
HX5 1-node (30 mm)	95 W, 105 W	5	14	14	14	14	14	10
	130 W	4	None‡	10	None‡	12	12	8
HX5 2-node (60 mm)	95 W, 105 W	2	7	7	7	7	7	5
	130 W	2	None‡	5	None‡	6	6	4
HX5 1-node + MAX5 (60mm)	95 W, 105 W	2	7	7	7	7	7	5
	130 W	2	6	6	7	7	7	5
HX5 1-node + 1x BPE4 (60mm)	95 W, 105 W	None‡	7	7	7	7	7	6
	130 W	None‡	7	7	7	7	7	6

* IBM BladeCenter H 2980W AC Power Modules, 68Y6601 (standard in 4Tx, optional with all other BC-H chassis models)

† IBM BladeCenter H Enhanced Cooling Modules, 68Y6650 (standard in 4Tx, optional with all other BC-H chassis models)

‡ Not supported

Processor options

The HX5 supports the processor options listed in the following tables. The server supports one or two processors. It is supported to have one processor in a single-node + MAX5 configuration. It is also supported to have one processor in each node of a two-node system. You will, however, get better memory performance if both processor sockets are populated in each HX5.

Note that not all processors can scale to two nodes. These are indicated in the tables. In addition, the E7-2820 and the E7-2803 also do not support the attachment of the MAX5. This is a technical restriction of these specific processors.

Table 8. Processor options for machine type 7873 (Intel Xeon E7 series processors)

Part number	Intel Xeon processor description	Can scale to two-node	Models where used
88Y6124	Xeon E7-8867L 10C 2.13 GHz 30 MB 1066 MHz 105w	Yes	D1x
88Y6112	Xeon E7-8837 8C 2.67 GHz 24 MB 1066 MHz 130w	Yes	C1x
88Y6160	Xeon E7-4870 10C 2.40 GHz 30 MB 1066 MHz 130w	Yes	F2x
88Y6102	Xeon E7-4860 10C 2.26 GHz 24 MB 1066 MHz 130w	Yes	-
88Y6092	Xeon E7-4850 10C 2.00 GHz 24 MB 1066 MHz 130w	Yes	-
88Y6082	Xeon E7-4830 8C 2.13 GHz 24 MB 1066 MHz 105w	Yes	B2x, F1x, G2x
88Y6076	Xeon E7-4820 8C 2.00 GHz 18 MB 978 MHz 105w	Yes	-
88Y6070	Xeon E7-4807 6C 1.86 GHz 18 MB 800 MHz 95w	Yes	B1x, F3x
88Y6150	Xeon E7-2870 10C 2.40 GHz 30 MB 1066 MHz 130w	No	A3x
69Y3094	Xeon E7-2860 10C 2.26 GHz 24 MB 1066 MHz 130w	No	A2x
69Y3084	Xeon E7-2850 10C 2.00 GHz 24 MB 1066 MHz 130w	No	-
69Y3074	Xeon E7-2830 8C 2.13 GHz 24 MB 1066 MHz 105w	No	A1x
69Y3068	Xeon E7-2820 8C 2.00 GHz 18 MB 978 MHz 105w	No*	-
69Y3062	Xeon E7-2803 6C 1.73 GHz 18 MB 800 MHz 105w	No*	-

* The E7-2820 and the E7-2803 also do not support the attachment of the MAX5

Memory options

The BladeCenter HX5 and the MAX5 memory expansion blade support DDR3 memory. The server has 16 DIMM sockets and the MAX5 has 24 DIMM sockets. When only one processor is installed, only eight of the 16 DIMM sockets in the server are active (all sockets in the MAX5 are active, however).

The following tables lists memory options available for the HX5 server and for the MAX5 memory expansion unit. Memory must be installed in pairs of two identical DIMMs per processors installed. Although the DIMM pairs installed can be of different sizes, the pairs must be of the same speed.

Table 9. Memory options for machine type 7873 (Intel Xeon E7 series processors)

Part number	Description	Supported in HX5 7873	Supported in MAX5 V2 88Y6128	Supported in MAX5 V1 46M6973	Maximum quantity supported	Standard models where used
46C0560	2GB (1x2GB, 1Rx8, 1.35V) PC3L-10600 CL9 ECC DDR3 1333	Yes	Yes	No	16 (+MAX5: 40)	-
46C0564	4GB (1x4GB, 2Rx8, 1.35V) PC3L-10600 CL9 ECC DDR3 1333	Yes	Yes	No	16 (+MAX5: 40)	A1x, A2x, A3x, B1x, B2x, BAx, BBx, BHx, BJx, C1x, CAx, CHx, D1x, DAx, DHx, F1x, F2x, F3x, FAx, FBx, FHx, FJx, H1x, H2x, H3x
46C0570	8GB (1x8GB, 4Rx8, 1.35V) PC3L-8500 CL7 ECC DDR3 1066	Yes	Yes	No	16 (+MAX5: 40)	A4x, A5x, A6x, B3U, G1x, G2x, G3x, G4x, E1x, E2x, E3x, E4x, 91x, 92x, 93x, 94x
46C0599	16GB (1x16GB, 2Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333	Yes	Yes	No	16 (+MAX5: 40)	A6x, A7x
90Y3221	16GB (1x16GB, 4Rx4, 1.35V) PC3L-8500 CL7 ECC DDR3 1066	Yes	Yes	No	16 (+MAX5: 40)	-
00D5008	32GB (1x32GB, 4Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333	Yes	Yes	No	16 (+MAX5: 40)	-
44T1596	4GB (1x4GB, 2Rx8, 1.5V) PC3-10600 CL9 ECC DDR3 1333	No	No	Yes	24 (MAX5 only)	-
46C7499	8GB (1x8GB, 4Rx8, 1.5V) PC3-8500 CL7 ECC DDR3 1066	No	No	Yes	24 (MAX5 only)	-

* Redundant Bit Steering is supported in the MAX5 when this DIMM is installed exclusively.

The following memory protection technologies are supported:

- ECC
- ChipKill
- Memory Mirroring
- Memory Sparing
- Redundant Bit Steering (MAX5 or servers with E7 processors only, x4 DIMMs only)

Internal disk storage options

The storage system on the HX5 blade is based on the use of the optional SSD Expansion Card for IBM BladeCenter HX5, which contains an LSI 1064E SAS Controller and two 1.8-inch micro SATA drive connectors. The SSD Expansion Card allows the attachment of two 1.8-inch solid state drives (SSDs). If two SSDs are installed, the HX5 supports RAID-0 or RAID-1 capability. The SSD Expansion Card is installed in a dedicated slot (Figure 2) and does not block either the CFFh or the CIOv slot.

Installation of the SSDs in the HX5 requires the SSD Expansion Card for IBM BladeCenter HX5, as listed in the following table. Only one SSD Expansion Card is needed for either one or two SSDs.

Table 10. SSD Expansion Card

Part number	Name	Maximum quantity supported
46M6908	SSD Expansion Card for IBM BladeCenter HX5	1

The following tables list the hard drive options available for internal storage.

Table 11. Disk drive options for internal disk storage for machine type 7873 (Intel Xeon E7 series processors)

Part number	Description	Maximum quantity supported
43W7726	IBM 50GB SATA 1.8" MLC SSD	2
00W1120	IBM 100GB SATA 1.8" MLC Enterprise SSD	2
49Y6119	IBM 200GB SATA 1.8" MLC Enterprise SSD	2
43W7746	IBM 200GB SATA 1.8" MLC SSD	2
49Y6124	IBM 400GB SATA 1.8" MLC Enterprise SSD	2

Internal backup units

The server does not support an internal tape drive option.

Optical drives

The server does not support an optical drive option. However, it does interface to the optical drive installed in the BladeCenter chassis media tray if one is installed there.

I/O expansion options

The HX5 server offers the following PCI Express 2.0 slots. Neither are hot-swap.

- CIOv expansion slot
- CFFh expansion slot

The CIOv I/O expansion connector provides I/O connections through the midplane of the chassis to modules located in bays 3 and 4 of a supported BladeCenter chassis. It is a PCIe 2.0 x8 slot.

The CFFh I/O expansion connector provides I/O connections to high-speed switch modules that are located in bays 7, 8, 9, and 10 of a BladeCenter H or BladeCenter HT chassis, or to switch bay 2 in a BladeCenter S chassis. The CFFh slot is a PCIe x16 slot.

The MAX5 does not include any I/O expansion slots.

Some models include the IBM BladeCenter PCIe Gen 2 Expansion Blade as standard. This expansion blade is optional on others. The expansion blade provides the capability to attach selected PCI Express cards to the HX5. This capability is ideal for many applications that require special telecommunications network interfaces or hardware acceleration using a PCI Express card.

The expansion blade provides one full-height and full-length PCI Express slot and one full-height and half-length PCI Express slot with a maximum power usage of 75 watts for each slot. It integrates PCI Express card support capability into the BladeCenter architecture. Up to three expansion blades can be attached to a single-node HX5. Up to two expansion blades can be attached to a two-node HX5. The following table lists the external SAS cable for external storage expansion enclosures.

Table 12. Expansion blades

Part number	Description	Maximum quantity supported
46M6730	IBM BladeCenter PCI Express Gen 2 Expansion Blade	Single-node HX5: 3; Two-node HX5: 2
68Y7484	IBM BladeCenter PCI Express Gen 2 Expansion Blade II	Single-node HX5: 3; Two-node HX5: 2

For details, see the *IBM BladeCenter PCI Express Gen 2 Expansion Blade at-a-glance guide*, TIPS0783, available at: <http://www.redbooks.ibm.com/abstracts/tips0783.html?Open>

Network adapters

The HX5 offers two integrated Gigabit Ethernet ports, based on the Broadcom BCM5709S controller:

- Failover, adapter fault tolerance
- PXE 2.0 Boot Agent
- Wake on LAN
- Load balancing or teaming

Some models also have an Emulex Virtual Fabric 10Gb Expansion Card installed as standard in the CFFh slot. See Table 2 for specific details. For technical details about this card, see the IBM Redbooks® at-a-glance guide *Emulex 10GbE Virtual Fabric Adapter and Virtual Fabric Adapter Advanced for IBM BladeCenter*, TIPS0748, available at <http://www.redbooks.ibm.com/abstracts/tips0748.html?Open>

The following table lists additional supported network adapters.

Table 13. Network adapters

Part number	Description	Slots supported	Maximum supported
10 Gb Ethernet			
42C1810	Intel 10Gb 2-port Ethernet Expansion Card (CFFh)	CFFh	1
42C1830	QLogic 2-pt 10Gb Converged Network Adapter (CFFh)	CFFh	1
46M6164	Broadcom 10Gb Gen2 4-port Ethernet Expansion Card (CFFh)	CFFh	1
46M6168	Broadcom 10Gb Gen2 2-port Ethernet Expansion Card (CFFh)	CFFh	1
49Y4235	Emulex 10GbE Virtual Fabric Adapter (CFFh)	CFFh	1
49Y4275	Emulex 10GbE Virtual Fabric Adapter Advanced (CFFh)	CFFh	1
81Y1650	Brocade 2-port 10GbE Converged Network Adapter (CFFh)	CFFh	1
90Y3550	Emulex 10GbE Virtual Fabric Adapter II (CFFh)	CFFh	1
1 Gb Ethernet			
44W4479	2/4 Port Ethernet Expansion Card (CFFh)	CFFh	1
Combination Ethernet and Fibre Channel			
44X1940	QLogic Eth and 8Gb Fibre Channel Exp Card (CFFh)	CFFh	1
InfiniBand			
46M6001	2-port 40Gb InfiniBand Expansion Card (CFFh)	CFFh	1

Storage host bus adapters

The following table lists storage HBAs supported by the HX5 server.

Table 14. Storage adapters

Part number	Description	Slots supported	Maximum quantity supported
Combination Ethernet and Fibre Channel			
44X1940	QLogic Eth and 8Gb Fibre Channel Exp Card (CFFh)	CFFh	1
Fibre Channel			
44X1945	QLogic 8Gb Fibre Channel Expansion Card (CIOv)	CIOv	1
46M6065	QLogic 4Gb Fibre Channel Expansion Card (CIOv)	CIOv	1
46M6140	Emulex 8Gb Fibre Channel Expansion Card (CIOv)	CIOv	1
SAS			
43W4068	SAS Connectivity Card (CIOv)*	CIOv	1

* The SSD Expansion Card (46M6908) is required to support the SAS Connectivity Card (CIOv).

PCIe SSD adapters

The server supports the High IOPS SSD adapters listed in the following table. The adapters must be installed in an IBM BladeCenter PCI Express Gen 2 Expansion Blade.

Table 15. SSD adapters

Part number	Description	Slots supported	Max quantity
46M0878	IBM 320GB High IOPS SD Class SSD PCIe Adapter	PCIe Gen 2 Expansion Blade	2

For information about this adapter, see the *IBM High IOPS SSD PCIe Adapters at-a-glance guide*, TIPS0729: <http://www.redbooks.ibm.com/abstracts/tips0729.html?Open>

Power supplies

Server power is derived from the power supplies installed in the BladeCenter chassis. There are no server options regarding power supplies.

Integrated virtualization

The server supports VMware ESXi installed on a USB memory key. The key is installed in a USB socket inside the server. The following table lists the virtualization options. The use of the MAX5 requires that VMware ESXi 4.1 or later be used. Similarly, the HX5 with Xeon E7 processors (machine type 7873) requires VMware ESXi 4.1 and does not support ESXi 4.0.

Table 16. Virtualization options

Part number	Description	Maximum quantity supported
41Y8287	IBM USB Memory Key for VMware ESXi 4.1 with MAX5	-
41Y8298	IBM Blank USB Memory Key for VMware ESXi downloads	-
41Y8300	IBM USB Memory Key for VMware ESXi 5.0	-

Remote management

The server contains an IBM Integrated Management Module (IMM), which interfaces with the advanced management module in the BladeCenter chassis. The combination of these two provides advanced service-processor control, monitoring, and an alerting function. If an environmental condition exceeds a threshold or if a system component fails, LEDs on the system board are lit to help you diagnose the problem, records the error in the event log, and alerts you to the problem. A virtual presence capability is also available for remote server management capabilities.

Remote server management is provided through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3
- Common Information Model (CIM)
- Web browser

The server also supports virtual media and remote control features that provide the following functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz, regardless of the system state
- Remotely accessing the server using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive
- Capture blue-screen errors

Supported operating systems

The server supports the following operating systems:

- Microsoft Windows Server 2012
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008 HPC Edition
- Microsoft Windows Small Business Server 2008 Premium Edition
- Microsoft Windows Small Business Server 2008 Standard Edition
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- SUSE LINUX Enterprise Server 10 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- VMware ESX 4.1
- VMware ESXi 4.1
- VMware vSphere 5

See the IBM ServerProven® website for the latest information about the specific versions and service levels supported and any other prerequisites:

<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/nos/matrix.shtml>

Physical specifications

Dimensions:

- Height: 245 mm (9.7 in)
- Depth: 446 mm (17.6 in)
- Width: 58 mm (2.28 in)

Maximum weight: 9.5 kg (21 lb) (depending on the configuration when options are added)

Warranty options

The BladeCenter HX5 has a 3-year onsite warranty with 9x5/next-business-day terms. IBM offers the warranty service upgrades through IBM ServicePacs®, discussed in this section. The IBM ServicePac is a series of prepackaged warranty maintenance upgrades and post-warranty maintenance agreements with a well-defined scope of services, including service hours, response time, term of service, and service agreement terms and conditions.

IBM ServicePac offerings are country-specific. That is, each country might have its own service types, service levels, response times, and terms and conditions. Not all covered types of ServicePacs might be available in a particular country. For more information about IBM ServicePac offerings available in your country, see the IBM ServicePac Product Selector at <https://www-304.ibm.com/sales/gss/download/spst/servicepac>.

The following table explains warranty service definitions in more detail.

Table 17. Warranty service definitions

Term	Description
IBM onsite repair (IOR)	A service technician will come to the server's location for equipment repair.
24x7x2 hour	A service technician is scheduled to arrive at your customer's location within two hours after remote problem determination is completed. We provide service around the clock, every day, including IBM holidays.
24x7x4 hour	A service technician is scheduled to arrive at your customer's location within four hours after remote problem determination is completed. We provide service around the clock, every day, including IBM holidays.
9x5x4 hour	A service technician is scheduled to arrive at your customer's location within four business hours after remote problem determination is completed. We provide service from 8:00 a.m. to 5:00 p.m. in the customer's local time zone, Monday through Friday, excluding IBM holidays. If after 1:00 p.m. it is determined that onsite service is required, the customer can expect the service technician to arrive the morning of the following business day. For noncritical service requests, a service technician will arrive by the end of the following business day.
9x5 next business day	A service technician is scheduled to arrive at your customer's location on the business day after we receive your call, following remote problem determination. We provide service from 8:00 a.m. to 5:00 p.m. in the customer's local time zone, Monday through Friday, excluding IBM holidays.

In general, the types of IBM ServicePacs are:

- Warranty and maintenance service upgrades
 - One, 2, 3, 4, or 5 years of 9x5 or 24x7 service coverage
 - Onsite repair from next business day to 4 or 2 hours
 - One or two years of warranty extension
- Remote technical support services
 - One or three years with 24x7 coverage (severity 1) or 9x5/next business day for all severities
 - Installation and startup support for System x® servers
 - Remote technical support for System x servers
 - Software support - Support Line
 - Microsoft or Linux software
 - VMware
 - IBM Director

Regulatory compliance

The server conforms to the following international standards:

- Australia and New Zealand C-Tick Mark, Class A
- CE Mark (EN55022:1998 Class A, EN60950, EN55024:1998, EN61000-3-2 and EN61000-3-3)
- CISPR 22, Class A
- CSA C22.2 No.60950 Safety of Information Technology Equipment 60950
- Canada ICES-003, issue 3, Class A
- China GB 9254-1998, GB17625.1-1998, GB17625.2-1999
- FCC - Verified to comply with Part 15 of the FCC Rules (Class A) prior to product delivery
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- IEC 60950 CB Certificate and CB Test Report indicating compliance to Group Differences
- IEC-60950 (CB Certificate and CB Test Report)
- Japan VCCI, Class A
- Korea MIC
- NOM-019 Seguridad de Equipo de Procesamiento de Datos within 30 days of planned availability
- TUV-GS (EN60950/ISO 9241-3/ISO 9241-8)
- Taiwan BSMI CNS13438, Class A
- UL 60950 Safety of Information Technology Equipment

External disk storage expansion

The server does not support external storage expansion.

External disk storage systems

The following table lists the external storage systems that are supported by the server and can be ordered through System x sales channel. The server may support other IBM disk systems that are not listed in this table. Refer to IBM System Storage Interoperability Center for further information, <http://www.ibm.com/systems/support/storage/ssic>.

Table 18. External disk storage systems

Part number	Description
1746A2D	IBM System Storage DS3512 Express Dual Controller Storage System
1746A2S	IBM System Storage DS3512 Express Single Controller Storage System
1746A4D	IBM System Storage DS3524 Express Dual Controller Storage System
1746A4S	IBM System Storage DS3524 Express Single Controller Storage System
181494H	IBM System Storage DS3950 Model 94
181498H	IBM System Storage DS3950 Model 98
181492H	IBM System Storage EXP395 Expansion Unit
1746A2E	IBM System Storage EXP3512 Express Storage™ Expansion Unit
1746A4E	IBM System Storage EXP3524 Express Storage Expansion Unit

For more information, see the list of IBM Redbooks Product Guides in the Storage Systems category: <http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=externalstorage>

External backup units

The server supports the external backup attachment options listed in the following table.

Table 19. External backup options (Part 1)

Part number	Description
External tape expansion enclosures for internal tape drives	
87651UX	1U Tape Drive Enclosure
8767HHX	Half High Tape Drive Enclosure
87651NX	1U Tape Drive Enclosure (with Nema 5-15P LineCord)
8767HNX	Half High Tape Drive Enclosure (with Nema 5-15P LineCord)
Tape enclosure adapters (with cables)	
44E8869	USB Enclosure Adapter Kit
40K2599	SAS Enclosure Adapter Kit
Internal backup drives supported by external tape enclosures	
46C5364	IBM RDX Removable Hard Disk Storage System - Internal USB 160 GB Bundle
46C5387	IBM RDX Removable Hard Disk Storage System - Internal USB 320 GB Bundle
46C5388	IBM RDX Removable Hard Disk Storage System - Internal USB 500 GB Bundle
46C5399	IBM DDS Generation 5 USB Tape Drive
39M5636	IBM DDS Generation 6 USB Tape Drive
43W8478	IBM Half High LTO Gen 3 SAS Tape Drive
44E8895	IBM Half High LTO Gen 4 SAS Tape Drive
49Y9898	IBM Half High LTO Gen 5 Internal SAS Tape Drive

Table 19. External backup options (Part 2)

Part number	Description
External backup units*	
362516X	IBM RDX Removable Hard Disk Storage System - External USB 160 GB Bundle
362532X	IBM RDX Removable Hard Disk Storage System - External USB 320 GB Bundle
362550X	IBM RDX Removable Hard Disk Storage System - External USB 500 GB Bundle
3628L3X	IBM Half High LTO Gen 3 External SAS Tape Drive (with US line cord)
3628L4X	IBM Half High LTO Gen 4 External SAS Tape Drive (with US line cord)
3628L5X	IBM Half High LTO Gen 5 External SAS Tape Drive (with US line cord)
3628N3X	IBM Half High LTO Gen 3 External SAS Tape Drive (without line cord)
3628N4X	IBM Half High LTO Gen 4 External SAS Tape Drive (without line cord)
3628N5X	IBM Half High LTO Gen 5 External SAS Tape Drive (without line cord)
3580S3V	System Storage TS2230 Tape Drive Express Model H3V
3580S4V	System Storage TS2240 Tape Drive Express Model H4V
3580S5E	System Storage TS2250 Tape Drive Express Model H5S
3580S5X	System Storage TS2350 Tape Drive Express Model S53
3572S4R	TS2900 Tape Library with LTO4 HH SAS drive & rack mount kit
3572S5R	TS2900 Tape Library with LTO5 HH SAS drive & rack mount kit
35732UL	TS3100 Tape Library Model L2U Driveless
35734UL	TS3200 Tape Library Model L4U Driveless
46X2682†	LTO Ultrium 5 Fibre Channel Drive
46X2683†	LTO Ultrium 5 SAS Drive Sled
46X2684†	LTO Ultrium 5 Half High Fibre Drive Sled
46X2685†	LTO Ultrium 5 Half High SAS Drive Sled
46X6912†	LTO Ultrium 4 Half High Fibre Channel Drive Sled
46X7117†	LTO Ultrium 4 Half High SAS DriveV2 Sled
46X7122†	LTO Ultrium 3 Half High SAS DriveV2 Sled

* Note: The external tape drives listed can be ordered through System x sales channel. Server may support other IBM tape drives that are not listed in this table. Refer to IBM System Storage Interoperability Center for further information.

† Note: These part numbers are the tape drives options for 35732UL and 35734UL.

For more information, see the list of IBM Redbooks Product Guides in the Backup units category:
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pg&cat=tape>

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Related publications and links

For more information see the following resources:

- IBM BladeCenter HX5 product page
<http://ibm.com/systems/bladecenter/hardware/servers/hx5>
- IBM BladeCenter Information Center
<http://publib.boulder.ibm.com/infocenter/bladectr/documentation>
- Installation and User's Guide - IBM BladeCenter HX5
<http://ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-5084612>
- Problem Determination and Service Guide - IBM BladeCenter HX5
<http://ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-5084529>
- ServerProven hardware compatibility page for the HX5
<http://ibm.com/systems/info/x86servers/serverproven/compat/us/blade/7873.html>
- ServerProven compatibility page for operating system support
<http://ibm.com/systems/info/x86servers/serverproven/compat/us/nos/ematrix.shtml>
- *BladeCenter Interoperability Guide*
<http://ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-5073016>
- At-a-glance guides for IBM BladeCenter servers and options
<http://www.redbooks.ibm.com/portals/bladecenter?Open&page=ataglance>
- *Configuration and Option Guide*
<http://www.ibm.com/systems/xbc/cog/>
- xRef - IBM System x Reference Sheets
<http://www.redbooks.ibm.com/xref>
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