

Expandable Storage Plus

2104 Models DU3 and TU3 Hardware Technical Information

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First Edition (October 2000)

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About This Book

This book is intended for system designers, programmers, engineers, and other professionals who need to understand the 2104 Models DU3 and TU3.

Chapter 1 contains an introduction and general information about the components of the 2104 Models DU3 and TU3.

Chapter 2 contains a summary of the physical characteristics of the 2104 Models DU3 and TU3.

Chapter 3 contains information about the external connectors of the 2104 Models DU3 and TU3.

Related Publications

ANSI¹ specification SCSI/2 X3T9.2/86-109 revision 10H

ANSI specification X3.131-199X

Site and Hardware Planning Information, SA38-0508

Adapters, Devices, and Cables Information for Multiple Bus Systems, SA38-0516

Expandable Storage Plus : 2104 Models DU3 and TU3 Operator's Guide, SA33-3310

Expandable Storage Plus : 2104 Model DU3 Installation Guide, GA33-3311

Expandable Storage Plus : 2104 Model TU3 Installation Guide, GA33-3312

Expandable Storage Plus : 2104 Models DU3 and TU3 Service Guide, GY33-0198

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- RS/6000
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1. American National Standards Institute.

Chapter 1. Introduction

This section describes the 2104 Models DU3 and TU3 and their components.

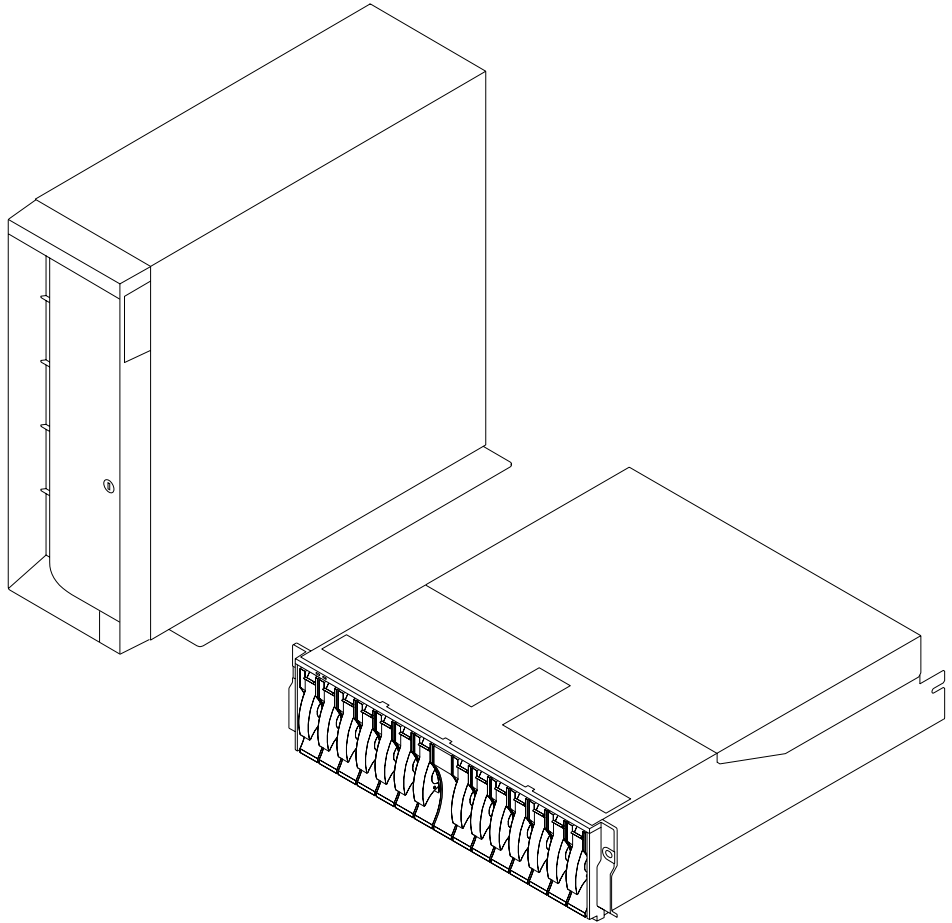


Figure 1. 2104 Model TU3 (on the Left) and 2104 Model DU3 (on the Right)

2104 Model DU3

The 2104 Model DU3 is a rack-mounted SCSI disk enclosure that can be attached to any RS/6000 or IBM[™] e[™] server[™] pSeries computer that provides support for any of the Small Computer System Interface (SCSI) adapters listed in “SCSI Adapters and Cables” on page 25.

A fully configured 2104 Model DU3 looks like this:

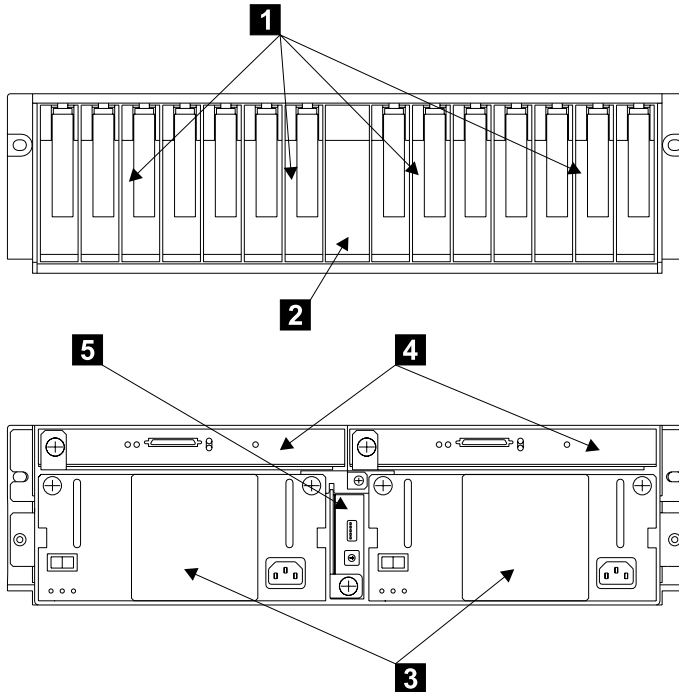


Figure 2. 2104 Model DU3 from the Front (Top) and Back (Bottom)

At the front of a 2104 Model DU3 there are 14 device slots **1**. In a fully configured 2104 Model DU3, each slot contains a SCSI disk drive module. If a 2104 Model DU3 is not fully configured, each slot that does not contain a SCSI disk drive module must contain a dummy module.

Note: At least one SCSI disk drive module must be present in each 2104 Model DU3. Each disk drive module connects to a backplane that is mounted vertically about halfway between the front and back of the 2104 Model DU3.

The 14 device slots are divided into two groups of seven slots. Between the two groups of slots there is a SCSI bus bridge card **2**. The SCSI bus bridge card assigns the disk drive modules to a SCSI bus, in accordance with the setting of the SCSI bus split switch on the switch card.

On the back of the backplane are connectors for two fan-and-power-supply assemblies **3**, two SCSI interface cards **4**, and a switch card **5**.

The 2104 Model DU3 has either two fan-and-power-supply assemblies or one fan-and-power-supply assembly and one fan assembly. Either option provides all the necessary power and cooling for the 2104 Model DU3.

The SCSI interface cards are used to connect host machines to the 2104 Model DU3. These cards contain logic that provides information about what is happening in the 2104 Model DU3 and the status of components within it.

The switch card contains switches that control which SCSI bus mode is selected, how the 2104 Model DU3 is supplied with power, and what enclosure services are enabled. It also contains a rotary switch that is used to set the ID of the 2104 Model DU3.

2104 Model TU3

The 2104 Model TU3 is a desktop SCSI disk enclosure that can be attached to any RS/6000 or IBM *e*server pSeries computer that provides support for any of the Small Computer System Interface (SCSI) adapters listed in "SCSI Adapters and Cables" on page 25.

A fully configured 2104 Model TU3 looks like this:

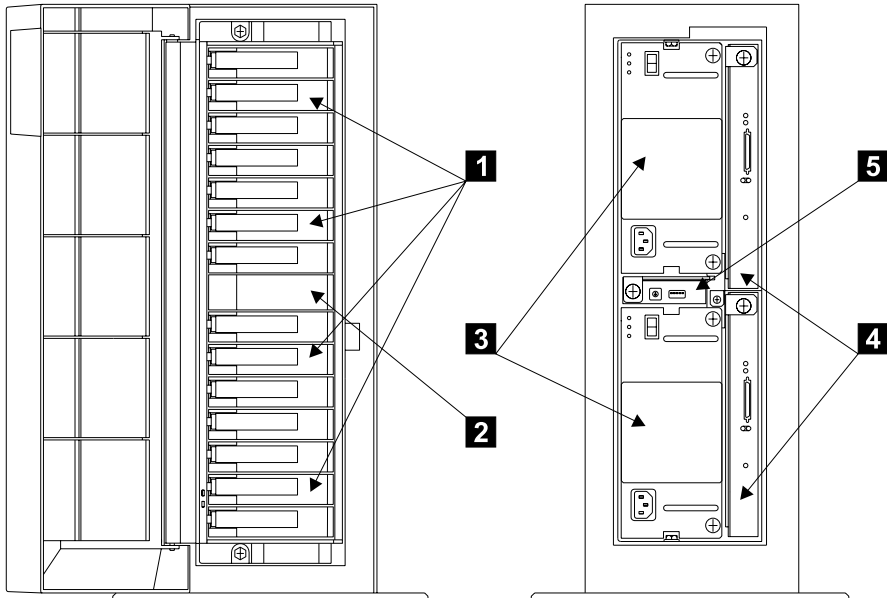


Figure 3. 2104 Model TU3 from the Front (Left) and Back (Right)

At the front of a 2104 Model TU3 are 14 device slots **1**. In a fully configured 2104 Model TU3, each slot contains a SCSI disk drive module. If a 2104 Model TU3 is not fully configured, each slot that does not contain a SCSI disk drive module must contain a dummy module.

Note: At least one SCSI disk drive module must be present in each 2104 Model TU3. Each disk drive module connects to a backplane that is mounted vertically about halfway between the front and back of the 2104 Model TU3.

The 14 device slots are split into two groups of seven slots. Between the two groups of slots, there is a SCSI bus bridge card **2**. The SCSI bus bridge card assigns the disk drive modules to a SCSI bus, in accordance with the setting of the SCSI bus split switch on the switch card.

On the back of the backplane are connectors for two fan-and-power-supply assemblies **3**, two SCSI interface cards **4**, and a switch card **5**.

The 2104 Model TU3 can have either two fan-and-power-supply assemblies or one fan-and-power-supply assembly and one fan assembly. Either option provides all the necessary power and cooling for the 2104 Model TU3.

The SCSI interface cards are used to connect host machines to the 2104 Model TU3. These cards contain logic that provides information about what is happening in the 2104 Model TU3, and controls the operation of the subsystem.

The switch card contains switches that control which SCSI bus mode is selected, how the 2104 Model TU3 is supplied with power, and what enclosure services are enabled. It also contains a rotary switch that is used to set the ID of the 2104 Model TU3.

SCSI Disk Drive Modules

Each 2104 Model DU3 or TU3 includes from one to fourteen SCSI disk drive modules. In your initial order, you can select the capacity of these disk drive modules. Each disk slot contains either a disk drive module or a dummy module. You can replace any dummy module with a disk drive module, or any disk drive module with a dummy module, but there must always be at least one disk drive module in each 2104 disk enclosure, and every disk slot must contain either a disk drive module or a dummy module. You can install the additional disk drive modules yourself.

The following IBM disks are allowed:

Nominal capacity	Nominal Speed in RPM	Feature Number
9.1 GB	10000	6109
18.2 GB	10000	6118
36.4 GB	10000	6136

Please obtain the latest product information from the following IBM Web address:

www.ibm.com/storage

SCSI Interface Cards

Attached to the back of the backplane in a fully configured 2104 Model DU3 or 2104 Model TU3 are two SCSI interface cards. Both cards can be used to connect host machines to the 2104 disk enclosure. A SCSI interface card provides the following functions:

- Supports SCSI Enclosure Services at the SCSI node at address 15 on the external SCSI bus
- Reads the Vital Product Data (VPD) for the backplane, the fan-and-power-supply assembly, the fan assembly, the switch card, the SCSI interface card, and the SCSI bus bridge card
- Inputs the fan-and-power-supply assembly fault lines
- Controls the fan-and-power-supply assembly fault LEDs and the fan assembly fault LED
- Controls the fault LED at the front of the 2104 Model DU3 or 2104 Model TU3
- Monitors the EPOW (Early Power-Off Warning) signal from the power supplies, and passes this information to the disks when needed
- Supports hot plugging of disk drive modules
- Detects and indicates faults within itself
- Supports LVD (low-voltage differential) Ultra3 SCSI (160MB per second data rate)

Note: Single-ended (SE) SCSI is not supported.

The other SCSI interface card detects and indicates only faults within itself. However, if the first SCSI interface card fails, the second SCSI interface card provides all the functions previously provided by the other SCSI interface card.

If the 2104 contains only one SCSI interface card, the SCSI interface card provides all the functions listed above.

Fan-and-Power-Supply Assemblies

Attached to the back of the backplane in a fully configured 2104 Model DU3 or 2104 Model TU3 are two fan-and-power-supply assemblies.

Each fan-and-power-supply assembly provides enough power for the 2104, so it is possible for there to be just one fan-and-power-supply assembly in a 2104. The second fan-and-power-supply assembly is replaced by a fan assembly. The fan-and-power-supply assembly provides the power for the fan assembly via the 2104 backplane.

Switch Card

Attached to the back of the backplane in a fully configured 2104 Model DU3 or 2104 Model TU3, the switch card contains switches that control some of the functions of the 2104.

Switches that are accessible from the back of the 2104 are provided to indicate:

- Whether power to the 2104 is turned on or off automatically when the host computer is switched on or off
- Whether the disk drive modules are started automatically when power to the 2104 is turned on
- Whether the disk drive modules are all started simultaneously or sequentially
- Whether enclosure services can operate
- Which enclosure services, ANSI SCSI-3 Enclosure Services (SES) or Conner/Intel SCSI-accessed Fault-tolerant Enclosures (SAF-TE), can operate
- The ID of the 2104

Switches that are accessible only when the switch card has been removed from the 2104 are provided to indicate:

- That the order of the SCSI addresses is reversed
- Whether the setting of the LEDs is for a rack-mounted unit or for a deskside unit
- Whether the 2104 is configured as single SCSI bus mode or dual SCSI bus mode

SCSI Bus Bridge Card

Located centrally in the front of a 2104 Model DU3 or 2104 Model TU3, the SCSI bus bridge card controls the SCSI bus configuration of the 2104. It assigns the disk drive modules to a SCSI bus, in accordance with the setting of the SCSI bus split switch on the switch card.

SCSI Bus Configurations

There are three valid configurations :

- Single bus, one initiator (SCSI ID 7), 14 disk drive modules (SCSI IDs 0 through 6, and 8 through 14)
- Single bus, two initiators (SCSI IDs 5 and 6), 12 disk drive modules (SCSI IDs 0 through 4, and 8 through 14)

Note: In this configuration, slots 6 and 7 (SCSI ID 5 and 6) contain dummy disk drive modules. SCSI ID 7 is reserved.

- Dual bus, two initiators (SCSI IDs 7 (x2)), 2 groups of 7 disk drive modules (SCSI IDs 0 through 6, and 8 through 14)

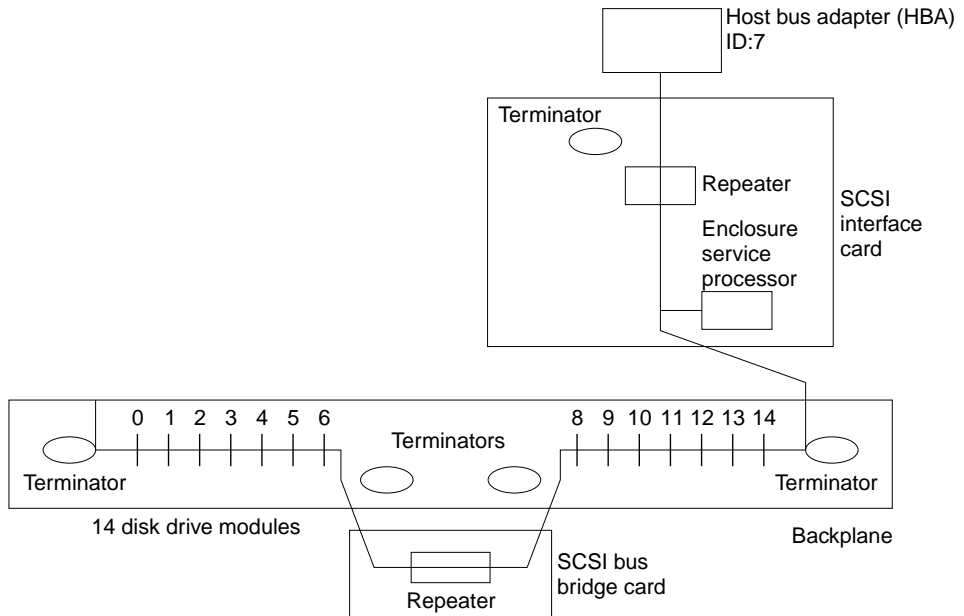


Figure 4. Single Bus, One Initiator, 14 Disk Drive Modules

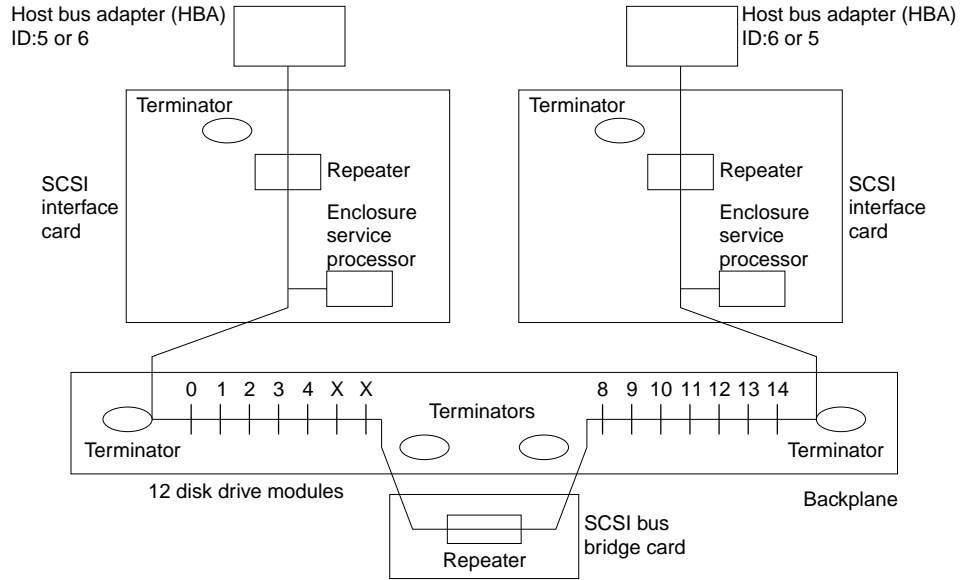


Figure 5. Single Bus, Two Initiators, 12 Disk Drive Modules

Notes:

1. The two Host Bus Adapters cannot have the same SCSI address.
2. Disk drive slots 6 and 7 (SCSI IDs 5 and 6) have dummy disk drive modules installed in them.

Note: In this configuration, SCSI addresses 5 and 6 cannot be used for disk drive modules.

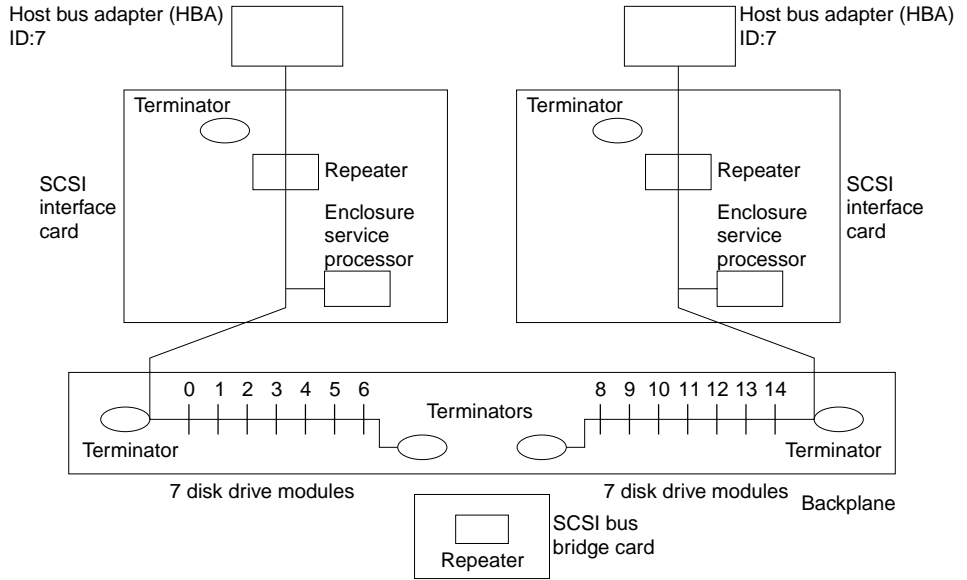


Figure 6. Dual Bus, Two Initiators, 14 (2 x 7) Disk Drive Modules

Chapter 2. Product Characteristics

This section describes the physical characteristics of the 2104 Model DU3 and 2104 Model TU3, and their environmental and power requirements.

Dimensions

Model	Height	Width	Depth
Model DU3	128 mm (5.0 in.) 3 EIA units	445 mm (18 in.)	552 mm max (22 in.)
Model TU3	529 mm (21 in.)	281 mm at foot (11 in.)	594 mm (23.5 in.)

Weight

The weight of a 2104 depends on its configuration.

Model	Configuration	Disk Drive Modules	Weight
Model DU3	Minimum	1	23.0 kg (51 lb)
	Maximum	14	38.5 kg (85 lb)
Model TU3	Minimum	1	39.6 kg (87 lb)
	Maximum	14	54.5 kg (120 lb)

Service Clearances

Model	Service Clearance
Model DU3	The minimum is 114 cm (45 in.) front and 81 cm (32 in.) rear when the 2104 is mounted in a rack
Model TU3	The minimum is 1 m (39 in.) front, back, and on each side.

Environment

Temperature and Humidity

A 2104 has the following environmental limits:

	Air Temperature	Relative Humidity	Maximum Wet Bulb
Operating	10°C to 40°C (50°F to 104°F)	8% to 80% noncondensing	27°C (80°F)
Recommended operating point	22°C (72°F)	45%	
Recommended operating range	20°C to 25°C (68°F to 77°F)	40% to 50%	
Nonoperating	10°C to 52°C (50°F to 126°F)	8% to 80% noncondensing	27°C (80°F)
Storing	1°C to 60°C (34°F to 140°F)	5% to 80% noncondensing	29°C (84°F)
Shipping	-40°C to 60°C (-40°F to 140°F)	5% to 100% condensing but not precipitating	29°C (84°F)

Notes:

1. The recommended operating temperature is 22°C (72°F) or lower. At lower temperatures, the risk of failure in the unit is reduced. If the operating temperature is above 22°C (72°F) for long periods of time, the 2104 is exposed to a greater risk of failure from external causes.
2. The nonoperating environment must not exceed the operating environment limits for longer than 60 days.
3. The storage environment must not exceed the operating environment limits for longer than 1 year.
4. Substantial deviations from the recommended operating range, in either direction, if sustained for extended periods of time, will expose the 2104 to greater risk of failure from external causes.

Altitude

Altitude (from sea level) limits for both models are:

Operating: 0 to 2133 m (0 to 7000 ft)

Nonoperating: -304.8 m to 12 192 m (-1000 to 40 000 ft)

Note: The upper dry bulb temperature limit of the rack-mounted unit is lowered by 1°C (2°F) for every 137 meters (450 feet) above 915 meters (3000 feet). The upper wet bulb temperature limit is lowered by 1°C (2°F) for every 274 meters (900 feet) above 305 meters (1000 feet).

Heat Output, Airflow, and Cooling

The maximum heat output of either model is 330 watts (1126 BTU/hr).

Each 2104 requires an airflow of 1.1 m³ (40 cubic feet) per minute.

When racks containing many 2104s are to be installed together, the following requirements must be met to ensure that the 2104s are adequately cooled:

- The airflow is in at the front of the rack and out at the back. To avoid moving exhaust air to the intake of another piece of equipment, racks should be positioned in alternate rows, back-to-back and front-to-front.
- The front of racks should be positioned on floor-tile seams, with a full line of perforated tiles immediately in front of the racks.
- Where racks are in rows front-to-front or back-to-back, there should be a gap of at least 1220 mm (48 in) separating the rows.
- To ensure proper airflow within each rack, the rack filler plates must be installed in unused positions. Also, all the gaps in the front of the racks must be sealed, including the gaps between the 2104s.

Electrical Power

Electrical power is supplied to each 2104 by either one or two fan-and-power-supply assemblies. These fan-and-power-supply assemblies convert the input voltage to dc for distribution within the 2104.

One fan-and-power-supply assembly provides enough power for a fully populated 2104.

If two fan-and-power-supply assemblies are present in the 2104, each disk drive module receives power from both fan-and-power-supply assemblies. If one fan-and-power-supply assembly fails, all disk drive modules can continue to operate.

Input-voltage Requirements

Main AC Supply

Fan-and-power-supply assemblies can run uninterrupted with ac inputs from 90 to 260 volts and from 47 to 63 Hz.

The 2104 is designed to operate within the limits of power line disturbance given in the table below.

Transient Voltage (rms)	Duration	Frequency	Nominal Voltage (rms)
287 V	2.0 s	47 to 63 Hz	240 V
70 V	2.0 s	47 to 63 Hz	100 V
65 V	0.5 s	47 to 63 Hz	100 V
0 V	20 ms	–	100 V

–48 Volts DC Supply

For Model DU3 units with the optional –48 V power supply feature, the input voltage must be in the range –40 V to –60 V.

The 2104 is designed to operate within the limits of power line disturbance given in the table below.

Transient Voltage	Duration	Frequency	Nominal Voltage
–65 V dc	1.0 s	N/A	<=60 V dc
–38 V dc	2.0 s	N/A	>=40 V dc
–35 V dc	0.5 s	N/A	>=40 V dc
0 V dc	3 ms	N/A	>=40 V dc

Power Input

The following table shows the power input that is needed for a 2104. The values shown are for a 2104 in which 14 disk drive modules are installed.

Description	Operating (100 disk ops per second)	Two power supplies (100 disk ops per second)
100 VAC input	410 W	210 W each
240 VAC input	430 W	220 W each

Power Factor

Power factor correction is applied within the fan-and-power-supply assemblies of each 2104. This maintains the power factor of the unit at not less than 0.95 at 50% of maximum load.

Output Protection

Each fan-and-power-supply assembly has over-current and over-voltage protection.

Early Power-Off Warning (EPOW)

Each fan-and-power-supply assembly provides an early power-off warning (EPOW) signal to the controlling SCSI interface card. When both fan-and-power-supply assemblies signal an EPOW, the controlling SCSI interface card signals an EPOW to each disk drive within the 2104.

Power Control

Each fan-and-power-supply assembly in the 2104 has a DC On/Standby switch.

The power to the 2104 is also controlled by the Power Control switch on the switch card.

Power Sequencing

The power sequencing of the disk drive modules in a 2104 is controlled by the settings of the Drive Auto-Start and Select Enclosure Services switches on the switch card. These are:

Drive Auto-Start switch	Select Enclosure Services switch	Power Sequence
OFF	OFF	Normal Start
ON	OFF	Command Start
OFF	ON	Delayed Start
ON	ON	Reserved

Auto Restart

2104s automatically restart when input power is restored within specification after a power failure. The disk drive module motors start under the control of the using system.

Safety Approvals

A 2104 Model DU3 or TU3 is certified to the following safety standards:

- IEC 60950 (International Electrotechnical Commission)
- EN 60950 (European Norm)
- CSA950/UL1950 Binational (CSA Underwriters Laboratories' binational ITE standard)

Electromagnetic Compatibility

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Neither the provider nor the manufacturer is responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Japanese Voluntary Control Council for Interference (VCCI) Statement

This product is a Class A Information Technology Equipment and conforms to the standards set by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). In a domestic environment, this product might cause radio interference, in which event the user might be required to take adequate measures.

Korean Government Ministry of Communication (MOC) Statement

Please note that this device has been approved for business purposes with regard to electromagnetic interference. If you find that this device is not suitable for your use, you can exchange it for one that is approved for non-business purposes.

New Zealand Compliance Statement

This is a Class A product. In a domestic environment this product might cause radio interference, in which event the user might be required to take adequate measures

International Electrotechnical Commission (IEC) Statement

This product has been designed and built to comply with (IEC) Standard 60950.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Industry Canada Compliance Statement

This Class A digital apparatus complies with IECs-003.

United Kingdom Telecommunications Requirements

This apparatus is manufactured to the International Safety Standard EN60950 and as such is approved in the U.K. under approval number NS/G/1234/J/100003 for indirect connection to public telecommunications systems in the United Kingdom.

European Union (EU) Statement

This product is in conformity with the protection requirements of EU council directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Neither the provider nor the manufacturer can accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of option cards not supplied by the manufacturer.

This product is in conformity with the EU council directive 73/23/EEC on the approximation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits. This conformity is based on compliance with the following harmonized standard: EN60950.

Radio Protection for Germany

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 30. August 1995 (bzw. der EMC EG Richtlinie 89/336):

Dieses Gerät ist berechtigt in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen. Verantwortlich für die Konformitätserklärung nach Paragraph 5 des EMVG ist die:

IBM Deutschland Informationssysteme GmbH, 70548 Stuttgart.

Informationen in Hinsicht EMVG Paragraph 3 Abs. (2) :

Das Gerät erfüllt die Schutzanforderungen nach EN 50082-1 und EN 55022 Klasse A.
--

EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden:
"Warnung: dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Massnahmen durchzuführen und dafür aufzukommen."

EN 50082-1 Hinweis:

"Wird dieses Gerät in einer industriellen Umgebung betrieben (wie in EN 50082-2 festgelegt), dann kann es dabei eventuell gestört werden. In solch einem Fall ist der Abstand bzw. die Abschirmung zu der industriellen Störquelle zu vergrössern."

Anmerkung:

Um die Einhaltung des EMVG sicherzustellen sind die Geräte, wie in den Handbüchern angegeben, zu installieren und zu betreiben.

Taiwan Class A Compliance Statement

警告使用者:

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Chapter 3. Physical Connections

Figure 7 shows the external connectors of the 2104 Model DU3. **1** are SCSI connectors and **2** are mainline power connectors.

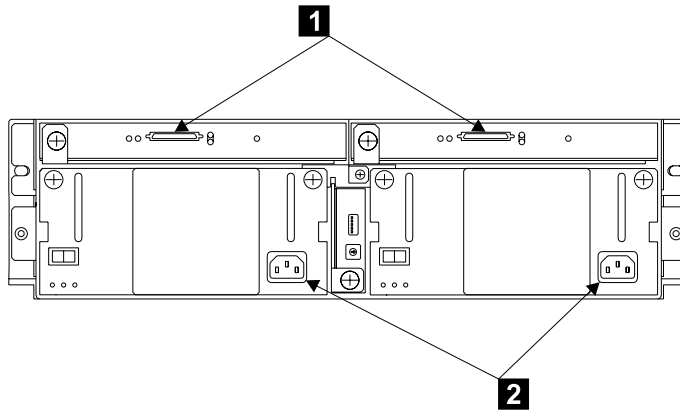


Figure 7. Back of a 2104 Model DU3 Showing External Connectors

Figure 8 shows the external connectors of the 2104 Model TU3. **1** are mainline power connectors and **2** are SCSI connectors.

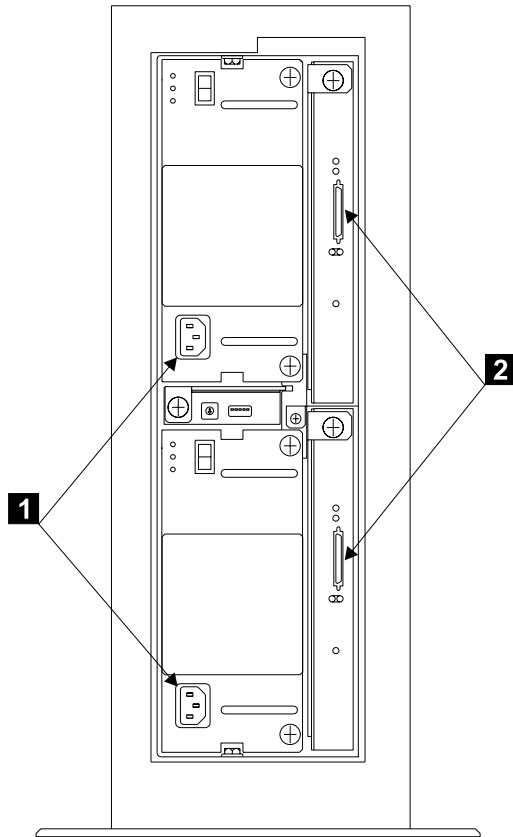


Figure 8. Back of a 2104 Model TU3 Showing External Connectors

This section provides information about these connectors.

SCSI Adapters and Cables

An RS/6000 or IBM @server pSeries computer uses one of the following SCSI adapters to connect to the 2104 Model DU3 or 2104 Model TU3:

- PCI 3-Channel Ultra2 SCSI RAID Adapter (Feature Code 2494 Type Number 4-T)
- PCI Dual Channel Ultra2 SCSI Adapter (Feature Code 6205 Type Number 4-R)
- PCI Single-Ended Ultra SCSI Adapter (Feature Code 6206 Type Number 4-K)
- PCI Single-Ended Plus SCSI RAID Adapter (Feature Code 6208 Type Number 4_A)
- PCI 4-Channel Ultra3 SCSI RAID Adapter/A (Feature Code 2498 Type Number 4-X)

The SCSI cables supported by these adapters are:

Adapter (Feature Code)	Cable Length	Feature Code	Part Number
6205 or 2494	20 meters	9320	09L3307
	10 meters	9310	09L3305
	5 meters	9305	09L3303
	3 meters	9303	09L3301
	1 meter	9301	09L3299
6206 or 2493	3 meters	9313	09L3309
2415	3 meters	9323	09L3311

Please obtain the latest product information from the following IBM Web address:

www.ibm.com/storage

Mainline-Power Connectors

Main AC Power Supply on a 2104 Model DU3 or 2104 Model TU3

A mainline-power connector is on each fan-and-power-supply assembly. The connector is a 10-amp, three-pin, polarized, IEC 320 input connector. See Figure 9, in which **1** is the ground connection, **2** is the neutral connection, and **3** is the live connection.

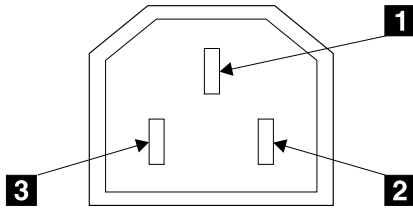


Figure 9. AC Mainline-Power Connector

–48 V Power Supply

There is one –48 V power connector on each fan-and-power-supply assembly in a 2104 Model DU3 that has this optional feature. This permits the 2104 to be connected to the –48 V dc rack power distribution panel. The connector is a 12-pin connector (see Figure 10).

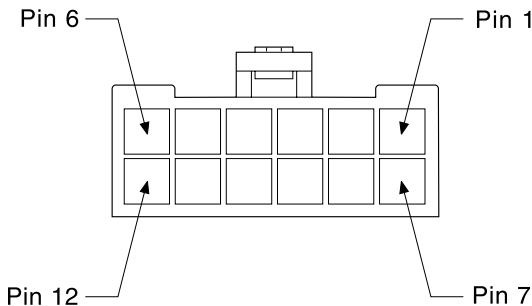


Figure 10. –48 V Power Connector (Viewed from the Back of the 2104)

Pin	Assignment	Pin	Assignment
1	Frame ground	7	Frame ground
2	Not used	8	Not used
3	–48 V return (0 V)	9	–48 V return (0 V)
4	–48 V return (0 V)	10	–48 V return (0 V)
5	–48 V in	11	–48 V in
6	–48 V in	12	–48 V in

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