

IBM Expandable Storage Plus

2104 Hardware Technical Information

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First Edition (September 1999)

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About This Book

This book is intended for system designers, programmers, engineers, and other professionals who need to understand the IBM Expandable Storage Plus disk enclosure.

This book contains the following:

- General information about the components of the IBM Expandable Storage Plus disk enclosure is given in Chapter 1
- A summary of the physical characteristics of the IBM Expandable Storage Plus disk enclosure is given in Chapter 2
- A description of the external connectors of the IBM Expandable Storage Plus disk enclosure is given in Chapter 3

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

IBM Expandable Storage Plus : 2104 Operator's Guide, SA33-3294

1. American National Standards Institute.

Chapter 1. Introduction

This section describes the IBM Expandable Storage Plus disk enclosure and its components.

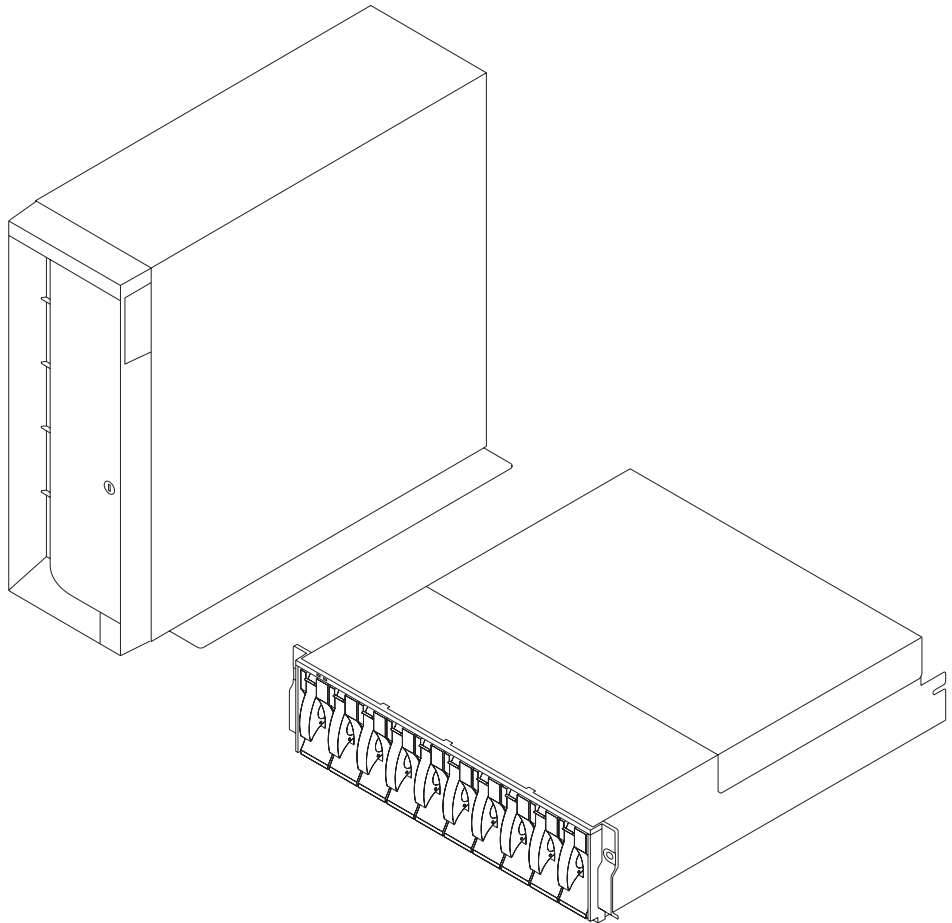


Figure 1. View of a 2104 Model TL1 (on the left) and a 2104 Model DL1 (on the right)

2104 Model DL1

The 2104 Model DL1 is a rack-mounted SCSI disk enclosure that can be attached to any computer that provides support for any of the Small Computer System Interface (SCSI) adapters listed in “SCSI Adapters and Cables” on page 21.

A fully configured 2104 Model DL1 looks like this:

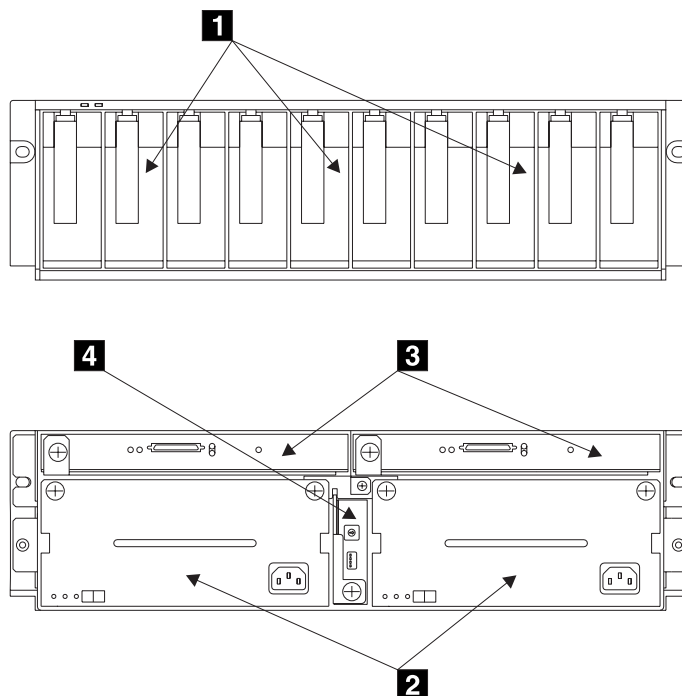


Figure 2. Fully configured 2104 Model DL1 from the front (top) and back (bottom)

At the front of a 2104 Model DL1 are ten device slots **1**. Each slot must contain either an SCSI disk drive module, or a dummy module. Each disk drive module connects to a backplane that is mounted vertically about halfway between the front and back of the 2104 Model DL1. Note that at least one SCSI disk drive module must be present in each 2104 Model DL1.

On the back of the backplane are connectors for two fan-and-power-supply assemblies **2**, two SCSI interface cards **3**, and a switch card **4**.

The 2104 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 disk enclosure.

The SCSI interface cards are used to connect host machines to the 2104 Model DL1. These cards contain logic that provides information about what is happening in the 2104 Model DL1, and controls the operation of the subsystem.

The switch card contains switches that control how the 2104 Model DL1 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 disk enclosure.

2104 Model TL1

The 2104 Model TL1 is a desktide SCSI disk enclosure that can be attached to any computer that provides support for any of the Small Computer System Interface (SCSI) adapters listed in “SCSI Adapters and Cables” on page 21.

A fully configured 2104 Model TL1 looks like this:

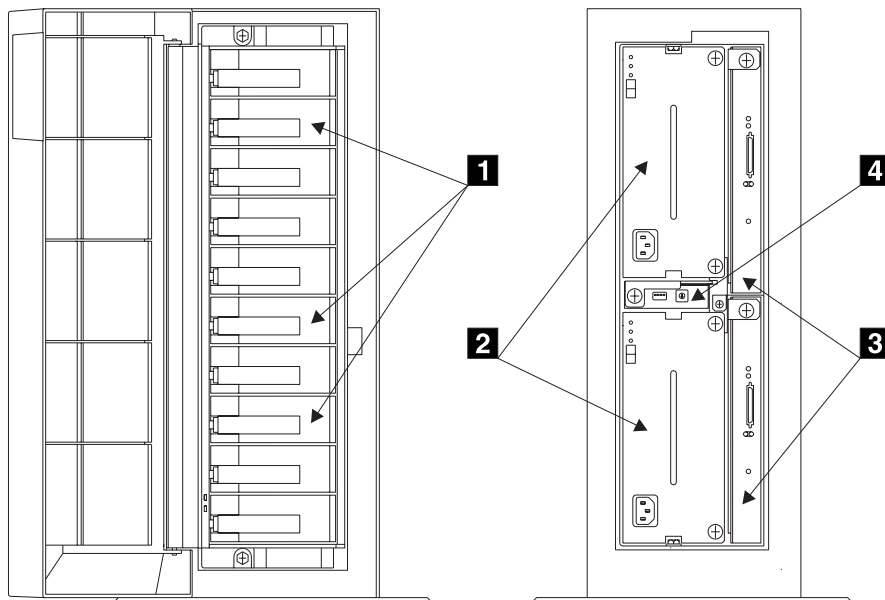


Figure 3. Fully configured 2104 Model TL1 from the front (left) and back (right)

At the front of a 2104 Model TL1 are ten device slots **1**. Each slot must contain either an SCSI disk drive module, or a dummy module. Each disk drive module connects to a backplane that is mounted vertically about halfway between the front and back of the 2104 Model TL1. Note that at least one SCSI disk drive module must be present in each 2104 Model TL1.

The 2104 Model TL1 has a front cover that hinges to the left to give access to the disk drive modules. A lock is provided on the cover to prevent unauthorized access to the disk drive modules.

On the back of the backplane are connectors for two fan-and-power-supply assemblies **2**, two SCSI interface cards **3**, and a switch card **4**.

The 2104 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 disk enclosure.

The SCSI interface cards are used to connect host machines to the 2104 Model TL1. These cards also contain logic that provides information about what is happening in the 2104 Model TL1, and controls the operation of the disk enclosure.

The switch card contains switches that control how the 2104 Model TL1 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 disk enclosure.

SCSI Disk Drive Modules

Each 2104 disk enclosure includes from one to ten SCSI disk drive modules. In your initial order, you can select the capacity of these disk drives. 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 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	Speed in RPM	Feature Number
9.1 GB	7200	5109
9.1 GB	10020	5209
18.2 GB	7200	5118
18.2 GB	10020	5218
36.4 GB	7200	5136

SCSI Interface Cards

Attached to the back of the 2104 backplane in a fully configured 2104 Model DL1 or 2104 Model TL1 are two SCSI interface cards. Both cards can be used to connect host machines to the 2104 disk enclosure. One SCSI interface card provides the following functions:

- SCSI Enclosure Services at the SCSI node at address 15 on the external SCSI bus
- Reads backplane and power supply VPD information
- Inputs the fan and power supply fault lines
- Controls the fan and power supply fault LEDs
- Controls the Check LED visible at the front of the 2104 Model DL1 or 2104 Model TL1
- 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 disks
- Detects and indicates faults within itself

The other SCSI interface card only detects and indicates 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 disk enclosure contains only one SCSI interface card, it provides all the functions listed above.

Power-Supply-and-Fan Assemblies

Attached to the back of the 2104 backplane in a fully configured 2104 Model DL1 or 2104 Model TL1 are two power-supply-and-fan assemblies.

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

Switch Card

Attached to the back of the 2104 backplane in a fully configured 2104 Model DL1 or 2104 Model TL1, the switch card contains switches which control some of the functions of the 2104 disk enclosure. Switches are provided to indicate:

- Whether power to the 2104 disk enclosure will be turned on or off automatically when the host is switched on or off
- Whether enclosure services will operate
- Which enclosure services (ANSI SCSI-3 Enclosure Services (SES) or Conner/Intel SCSI-accessed Fault-tolerant Enclosures (SAF-TE)) will operate

Note: SAF-TE services is not available on an RS/6000 system

- The ID of the 2104 disk enclosure

Chapter 2. Product Characteristics

This section describes the physical characteristics of the 2104 Model DL1 and 2104 Model TL1 and their environmental and power requirements.

Dimensions

Model	Height	Width	Depth
2104 Model DL1	126 mm (5.0 in.)3 EIA units	444 mm (17.5 in.)	546 mm (21.5 in.)
2104 Model TL1	529 mm (21 in.)	281 mm (11 in.)	594 mm (23.5 in.)

Weight

The weight of a 2104 disk enclosure depends on its configuration.

Model	Configuration	Disk Drive Modules	Weight
2104 Model DL1	Minimum	1	27.5 kg (61 lb)
	Maximum	10	38.5 kg (85 lb)
2104 Model TL1	Minimum	1	43.5 kg (96 lb)
	Maximum	10	54.5 kg (120 lb)

Note: When using 7014-S00, 7015-R00, 7202-900 or 2101-100 IBM rack systems, you can install up to 9 2104 disk enclosures, provided that there are sufficient Power Distribution Units (PDU's) in the rack. Other rack systems may have different strength limits.

Service Clearances

Model	Service Clearance
2104 Model DL1	The minimum is 114 cm (45 in.) front and 81 cm (32 in.) rear when the 2104 is mounted in a rack
2104 Model TL1	The minimum is 1 m (39 in.) front, rear, and on each side.

Environment

Temperature and Humidity

2104 disk enclosures have the following environmental limits:

	Air Temperature	Relative Humidity	Maximum Wet Bulb
Operating	10°C to 40°C (50°F to 104°F) See note	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 unit is exposed to a greater risk of failure from external causes.
2. Nonoperating environment must not exceed the operating environment limits for longer than 60 days.
3. Storage environment must not exceed 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 unit 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, Air Flow, and Cooling

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

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

When racks containing many 2104 disk enclosures are to be installed together, the following requirements must be met to ensure that the 2104 disk enclosures 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 air flow 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 2104 disk enclosures.

Electrical Power

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

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

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

Input-Voltage Requirements

Main AC Supply

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

Power line transients (within the limits given in the following table) do not interrupt the operation of the 2104 disk enclosure.

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

Power Input

The following table shows the power input that is needed for a 2104 disk enclosure. The values shown are for a 2104 disk enclosure that has 10 disk drive modules installed. The startup power assumes that no data transfer is occurring as the disk drive modules start up.

Description	Startup	Operating (100 ops per second)	Two power supplies (100 ops per second)
100 VAC input	404 W / 410 VA	320 W / 325 VA	162 W / 165 VA
240 VAC input	432 W / 466 VA	315 W / 340 VA	165 W / 180 VA

Power Factor

Power-factor correction is applied within the power-supply-and-fan assemblies of each 2104 disk enclosure. This maintains the power factor of the unit at greater than 0.77.

Output Protection

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

Early Power-Off Warning (EPOW)

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

Power Cables

Each 2104 disk enclosure is supplied with a country specific power cable.

Power Control

There is an On/Standby switch on each power supply in the 2104 disk enclosure.

Power Sequencing

2104 disk enclosures have no power sequencing. All the disk drive modules start their power sequence when the input voltages are inside the specified limits. The disk drive module motors start under the control of the using system.

Note: To prevent an excessive demand for current, the disk drive module motors must not all be started at the same time. If there are no I/O operations in progress on any started drives, up to 8 disk drive modules can be started at the same time, with a minimum interval of 10 seconds before more drives are started. Normal start time for all the disk drive modules is less than 30 seconds.

Auto Restart

2104 disk enclosures 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 disk enclosure 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 Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 30. August 1995.

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG das EG-Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM Deutschland.

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

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

EN55022 Klasse A Geräte bedürfen folgender Hinweise:

Nach dem EMVG: "Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministeriums für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind." (Auszug aus dem EMVG, Para.3, Abs.4). Dieses

Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung mit der entsprechenden Kostenverordnung (Amtsblatt 14/93) kostenpflichtig.

Nach der EN 55022: "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."

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 4 shows the external connectors of the 2104 Model DL1. **1** are SCSI connectors and **2** are mainline power connectors.

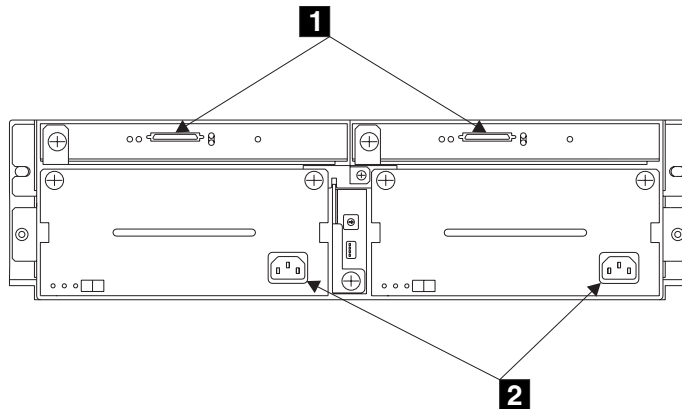


Figure 4. View of the back of the 2104 Model DL1 showing external connectors

Figure 5 shows the external connectors of the 2104 Model TL1. **1** are mainline power connectors and **2** are SCSI connectors.

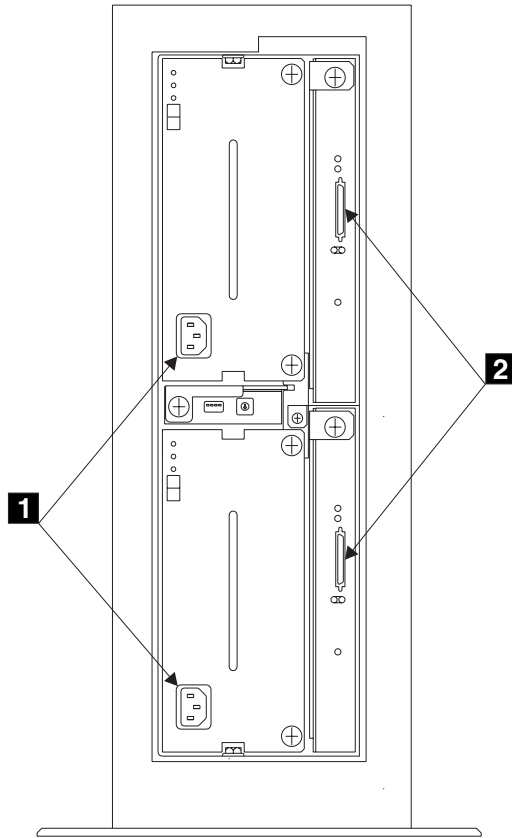


Figure 5. View of the back of the 2104 Model TL1 showing external connectors

This section provides information about these connectors.

SCSI Adapters and Cables

An RS/6000 uses one of the following SCSI adapters to connect to the 2104 Model DL1 or 2104 Model TL1:

- SCSI-2 Fast/Wide Adapter/A (Feature Code 2415 Type Number 4-7)
- PCI SCSI-2 F/W RAID Adapter (Feature Code 2493 Type Number 4-H)
- 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-T)
- PCI Single-Ended Plus SCSI RAID Adapter (Feature Code 6208 Type Number 4_A)

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

Mainline-Power Connectors

Main AC Power Supply on a 2104 Model DL1 or 2104 Model TL1

- A mainline-power connector is on each power-supply assembly. It permits the 2104 disk enclosure to be connected to the ac or dc power supply in the rack. The connector is a 10-amp, three-pin, polarized, IEC 320 input connector. See Figure 6. **1** is the ground connection, **2** is the neutral connection, and **3** is the live connection.

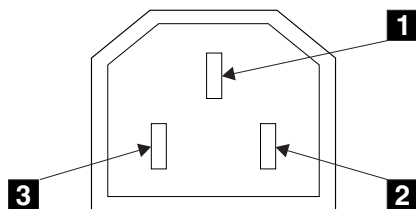


Figure 6. AC Mainline-Power Connector

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