

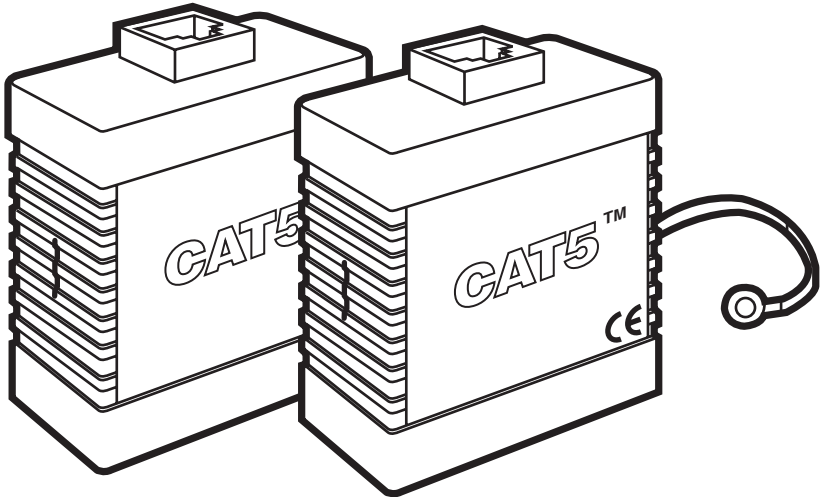


BLACK BOX[®]
NETWORK SERVICES



JANUARY 1996
SP250A
SP251A

Category 5 Primary and Secondary Surge Protectors



**CUSTOMER
SUPPORT
INFORMATION**

Order toll-free in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
FREE technical support, 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mail order: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: www.blackbox.com • E-mail: info@blackbox.com

NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT**INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

CATEGORY 5 PRIMARY AND SECONDARY SURGE PROTECTORS

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARK USED IN THIS MANUAL

ARCNET is a registered trademark of Datapoint Corporation.

Contents

Chapter	Page
1. Specifications	6
2. Introduction	8
2.1 General Overview	8
2.2 Important Features	9
3. Installation	10
3.1 Applications	10
3.2 Installation Procedures	12
Appendix A: IEC Compliance	14
Appendix B: EIA/TIA TSB-40A Compliance	15

1. Specifications

Compliance —	EN50082-1:1992 (including ISO [IEC] 801.2, 801.4, and 801.5), EIA/TIA TSB-40A
Standards —	Compatible with IEEE 802.3 Ethernet, low-speed (4-Mbps) IEEE 802.5 Token Ring, and IEEE 802.12 AnyLAN
Interfaces —	Compatible with most interfaces that make use of the RJ-45 connector and Category 5 cabling, including EIA/TIA RS-422 and RS-423, 10BASE-T, Type 3 Token Ring, 100BASE-T, 100VG-AnyLAN, and ATM

CAUTION!

Because of clamp-voltage limitations, the Surge Protectors are not compatible with ARCNET® or Type 1 Token Ring.

Maximum Data Rate —	100 Mbps
Response Time —	Clamped to 13 volts after 0.1 μ s
Characteristic Impedance —	100 ohms
NEXT Loss —	SP250A: Worst pair better than -43 dB at 100 MHz; SP251A: Worst pair better than -46 dB at 100 Mhz; See Appendix B
Surge Rating —	IEC 801.5 Standard Level
Surge Clamp Voltage —	SP250A: 15 volts maximum with 2-kV input; SP251A: 13 volts maximum with 1-kV input

DC Clamp Voltage —	Common Mode to Ground: Each line 7.5 volts at 50 mA; Differential Mode: Per pair: 8.1 volts at 50 mA
Grounding —	External ground strap provides separate unit-ground to chassis-ground contact
Insertion Loss —	Less than 0.4 dB at 100 Mhz (including connector)
Return Loss —	Better than 14 dB
Group Delay —	None (1 MHz to 100 MHz)
Series Resistance —	Less than 400 m Ω
Connectors —	(2) RJ-45 female
Leads/Signals Protected —	All
MTBF —	1,595,000 hours in a ground-benign environment (MIL-HDBK-217E)
Maximum Altitude —	10,000 ft. (3048 m)
Temperature Tolerance —	32 to 140° F (0 to 60° C)
Humidity Tolerance —	Up to 95% noncondensing
Size —	2.3"H x 1.7"W x 0.8"D (5.7 x 4.3 x 1.9 cm)
Weight —	1 lb. (0.5 kg)

2. Introduction

2.1 General Overview

Devices connected to Category 5 cabling systems are routinely threatened by unwanted electrical energy from sources such as lightning, AC-power induction, and ESD. Higher-speed devices—such as those operating at 100 Mbps—are especially vulnerable to the effects of these hazards, which can include data loss and hardware damage.

Our Category 5 Primary and Secondary Surge Protectors provide effective surge protection for devices operating in Category 5 cabling systems. The Secondary Surge Protector is specifically designed for point-of-use installation; the Primary Surge Protector is designed to be installed at the building entrance. Both models use a multi-stage Silicon Avalanche Diode circuit, and will continue functioning while handling surges up to the IEC 801.5 specification (see the tables in **Appendix B**). Both Surge Protectors will also protect against surges up to and exceeding 2kV/1kA in “fail-safe mode”: When hit by strong surges, they will fail, but in doing so they will short the line to ground so that the surge energy will not reach the protected equipment. (The Surge Protectors will also “fail-safe” in response to differences in ground potential—“ground loops”—that are not too severe.)

The Category 5 Surge Protectors support a wide range of balanced interfaces from EIA RS-422 to 100BASE-T. Highlights include a low insertion loss (less than 0.4 dB at 100 MHz) and minimal near-end crosstalk (“NEXT,” greater than -43 dB at all frequencies up to 100 MHz). Grounding is accomplished with an external ground strap that provides a separate unit-ground-to-chassis-ground connection.

CAUTION!

These surge protectors will not provide complete protection should your equipment or building be subject to a direct lightning hit, nor will they provide complete protection against severe differences in ground potential (“severe ground loops”).

2.2 Important Features

- Multi-level surge protection
- Operation at data rates up to 100 Mbps
- EIA/TIA TSB-40A Category 5 compliant
- NEXT better than -43 dB at 100 Mhz
- Shunts surges directly to chassis ground or building ground
- Easy to install

3. Installation

The Category 5 Surge Protectors are easy to install and are designed to be transparent to your network while they operate. This section describes the applications for which each model is designed and the procedures that you will use to install each model.

3.1 Applications

Both Surge Protectors protect all eight pins on the modular RJ-45 Category 5 interface, and they both work in environments with data rates up to 100 Mbps. However, the two models are designed for somewhat different applications. The following descriptions will give you a general guideline for installing the units in your Category 5 environment.

3.1.1 THE SECONDARY SURGE PROTECTOR (SP251A)

The Secondary Surge Protector (SSP) is designed to be installed on LAN equipment in a typical office environment (see Figure 3-1 below). For best results, you should connect the SSP as close as possible to the communication port of the device you want to protect (you might want to use the patch cable included with the SSP). Also, the flat braided grounding wire on the SSP should be attached to the grounded metal frame of the device being protected.

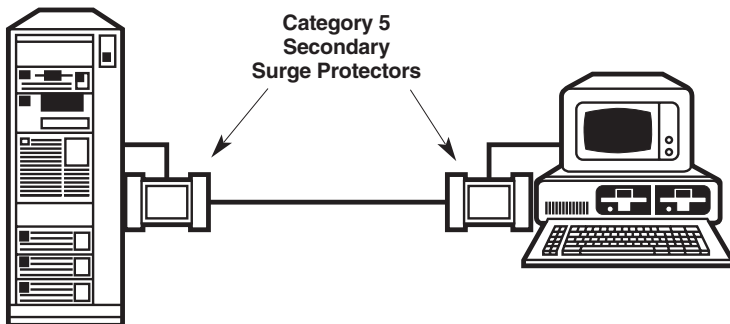


Figure 3-1. A typical point-of-use application for the SSP.

3.1.2 THE PRIMARY SURGE PROTECTOR (SP250A)

The Primary Surge Protector (PSP) is a more robust protector than the Secondary Surge Protector, and is designed for use as a barrier protector on LAN equipment in campus networks. Applications include cable runs between buildings, cable runs between floors on multi-story structures, and as a higher-capacity replacement for the SSP.

The PSP is also well suited for use in surge-prone areas, heavy industrial environments, and installations with heavy machinery in close proximity to sensitive LAN equipment and cabling. Figure 3-2, below, shows a typical application for the PSP. For best results, the braided grounding strap on the PSP should be attached to the grounded metal frame of the device being protected. When you install the PSP at a barrier such as an external wall, the braided strap should be connected to the building's electrical-safety ground.

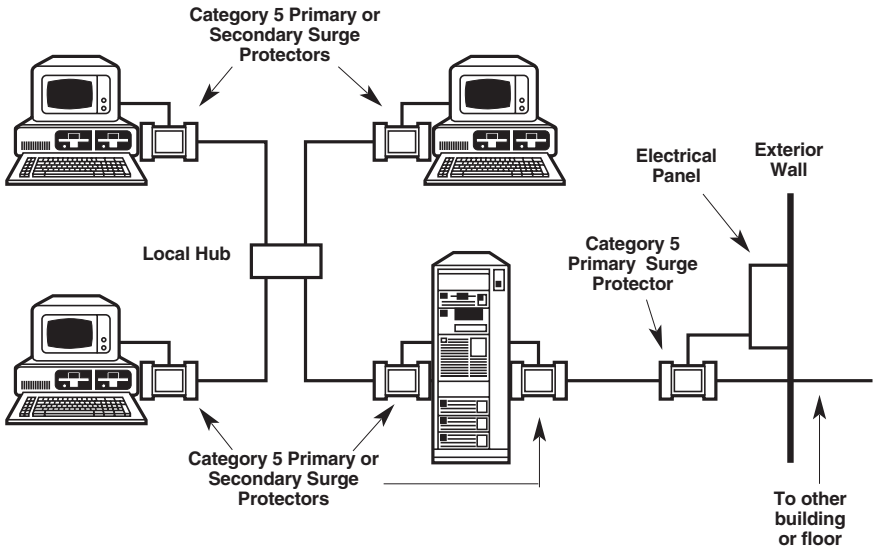


Figure 3-2. A typical barrier application for the PSP.

CATEGORY 5 PRIMARY AND SECONDARY SURGE PROTECTORS

3.2 Installation Procedures

In order to operate as designed, the Surge Protectors must be connected correctly to your Category 5 network. Please read all the instructions below and follow them carefully.

3.2.1 CONNECTING THE PSP OR SSP TO AN I/O PORT

1. Turn off or power down the the device you want to connect the Surge Protector to. Disconnect the specific twisted-pair line you want to protect from the device port it is currently attached to.
2. Install the Surge Protector between the incoming twisted-pair line and the port that the line was connected to (see Figure 3-3 below). You will have to run a straight-through-pinned Category 5 patch cable with modular RJ-45 connectors from the Surge Protector to the port; we suggest that you use the cable supplied with the Surge Protector. It doesn't matter which end of the Surge Protector is attached to the twisted-pair line and which end is attached to the patch cable.

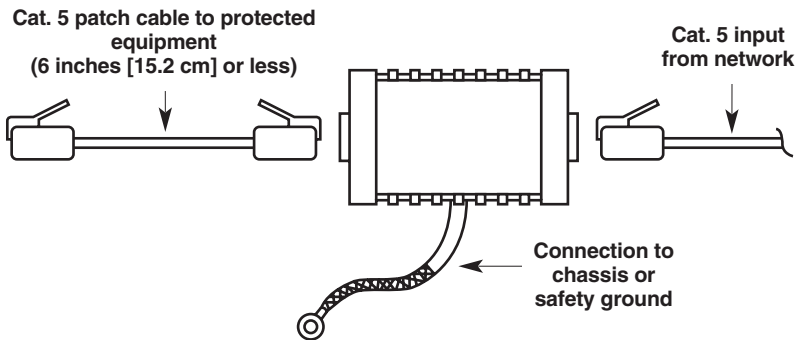


Figure 3-3. Installing a Surge Protector.

3. Locate a metal chassis ground on the device. This is often a hex screw on a D-shell or AUI connector. Sometimes a metal rear panel is attached to the rest of the device with screws, one of which can be used for chassis grounding. If you cannot locate a chassis-ground connection point on your equipment, contact your supplier's technical support to discuss an alternative grounding solution.

4. Attach the Surge Protector's braided ground strap directly to the chassis-ground connection point you have located (see Figure 3-3 on the previous page). The best way to make this connection is to attach the braided metal strap using a hex nut or screw on your device.

CAUTION!

Surge energy may run both directions on the ground strap. To provide the best protection, it is essential that the ground strap on the Surge Protector be connected to the chassis ground of the protected device. Do not lengthen the Surge Protector's ground strap or connect it to a ground other than chassis ground unless instructed to do so by your supplier's technical support.

3.2.2 CONNECTING THE PSP AT A BARRIER (WALL, BUILDING ENTRANCE, ETC.)

1. Disconnect the twisted-pair line you want to protect from the wall jack.
2. Install the Primary Surge Protector between the line and the jack. You will have to run a straight-through-pinned Category 5 patch cable with modular RJ-45 connectors from the PSP to the jack; we suggest that you use the cable supplied with the PSP. It doesn't matter which end of the PSP is attached to the twisted-pair line and which end is attached to the patch cable.
3. Find a common or on-equipment electrical ground close to the jack. We recommend that you use one of the building's electrical-safety grounds, such as an electrical panel or subpanel, but you can use a device's chassis ground if the chassis ground is connected to the building's electrical ground. If there are no grounds connected to the building's electrical-safety grounds within nine inches (23 cm) of the jack, contact your supplier's technical support to discuss an alternative grounding solution.
4. Connect the braided ground strap directly to the safety ground you have located. The best way to make this connection is to attach the braided metal strap to the metal panel using a hex nut or screw.

CAUTION!

Surge energy may run both directions on the ground strap. To provide the best protection, it is essential that the ground strap on the Surge Protector be connected to electrical safety ground. Do not lengthen the Surge Protector's ground strap or connect it to a ground not tied to safety ground unless instructed to do so by your supplier's technical support.

Appendix A: IEC Compliance

These Category 5 Surge Protectors meet IEC standards 801.2, 801.4, and 801.5 (CE Mark). Effective January 1996, the European Union requires that all electronic devices be tested and comply with all applicable international standards relating to the product's type and category of use. EMC Directive 89/336/EEC specifically addresses communication-line surge protection devices, since conformity to immunity standard EN50082-1:1992 is now mandatory. The EN50082-1:1992 standard incorporates ISO (IEC) Publications 801.2 and 801.4, which describe Electrostatic Discharge and Electrical Fast Transient requirements. ISO (IEC) 801.5 describes Surge Immunity Requirements (see Table A-1 below) and is expected to be adopted as a mandatory requirement under EN50082-1 in 1996. Any surge protector sold into the international community must meet these standards. These devices have been tested and found to comply with these standards, as evidenced by their CE marks.

Table A-1. IEC Threat Levels as a Function of Class

Class	Symmetrical Lines Coupling Mode Line = GND, Source Impedance = 42 ohms
1	1.0 kV at 24 A
2	1.0 kV at 24 A
3	2.0 kV at 48 A
4	N/A
5	4.0 kV at 95 A

Surge Waveforms (Voltage and Current): 1.2 x 50 μ s

Appendix B: EIA/TIA TSB-40A Compliance

The Category 5 Primary and Secondary Surge Protectors have been designed to conform to stringent EIA/TIA TSB-40A standards as required for all Category 5 connecting hardware. These standards specify capacitance and near-end crosstalk (NEXT) limits to help ensure proper operation of *all* connected equipment. Specific test results are shown in the tables on the following pages.

**Table B-1. Results of TSB-40A Compliance Testing, Part 1:
Typical Near-End Crosstalk Measurements**

NEXT Measurements for the Primary Surge Protector (SP250A)

Freq. (MHz)	SOURCE/VICTIM PAIRS						SPEC (dB)
	1-2/3-6 (dB)	1-2/4-5 (dB)	1-2/7-8 (dB)	3-6/4-5 (dB)	3-6/7-8 (dB)	4-5/7-8 (dB)	
1	>80	>80	>80	>80	>80	>80	>65
4	78	71.0	>80	75.0	73.0	77.0	>65
8	75	66.0	>80	70.0	77.0	66.0	62
10	70	63.0	>80	68.0	74.0	69.0	60
16	66	59.3	>80	64.0	80.0	72.0	56
20	65	57.6	>80	62.0	>80	66.0	54
25	64	56.0	>80	60.0	71.0	63.0	52
31.25	62	54.0	>80	58.0	66.0	61.0	50
62.5	54	48.6	80.0	51.0	60.0	58.0	44
100	48	52.0	59.0	45.0	56.0	43.0	40

NEXT Measurements for the Secondary Surge Protector (SP251A)

Freq. (MHz)	SOURCE/VICTIM PAIRS						SPEC (dB)
	1-2/3-6 (dB)	1-2/4-5 (dB)	1-2/7-8 (dB)	3-6/4-5 (dB)	3-6/7-8 (dB)	4-5/7-8 (dB)	
1	>80	>80	>80	>80	>80	>80	>65
4	77	74.0	>80	73.0	>80	74.0	>65
8	73	63.0	>80	68.0	75	69.0	62
10	67	67.3	>80	62.0	68.9	66.0	60
16	65	69.0	>80	58.0	68	62.0	56
20	64	63.0	>80	57.0	72	61.0	54
25	62	61.0	75.0	56.5	64	62.4	52
31.25	59	61.0	77.0	54.0	62	57.0	50
62.5	53	59.3	77.0	49.0	54.7	50.0	44
100	64	52.0	69.0	45.4	51	46.0	40

CATEGORY 5 PRIMARY AND SECONDARY SURGE PROTECTORS

**Table B-2. Results of TSB-40A Compliance Testing, Part 2:
Typical Attenuation Measurements**

Attenuation Measurements for the Primary Surge Protector (SP250A)

Freq. (MHz)	Pins 1-2 (dB)	Pins 3-6 (dB)	Pins 4-5 (dB)	Pins 7-8 (dB)	SPEC (dB)
1	0.0	0.0	0.0	0.0	0.1
4	0.0	0.0	0.0	0.0	0.1
8	0.0	0.0	0.0	0.0	0.1
10	0.0	0.0	0.0	0.0	0.1
16	0.0	0.0	0.0	0.0	0.2
20	0.0	0.0	0.1	0.0	0.2
25	0.1	0.0	0.0	0.0	0.2
31.25	0.1	0.1	0.1	0.2	0.2
62.5	0.2	0.1	0.2	0.3	0.3
100	0.2	0.2	0.3	0.3	0.4

Attenuation Measurements for the Secondary Surge Protector (SP251A)

Freq. (MHz)	Pins 1-2 (dB)	Pins 3-6 (dB)	Pins 4-5 (dB)	Pins 7-8 (dB)	SPEC (dB)
1	0.0	0.0	0.0	0.0	0.1
4	0.0	0.0	0.0	0.0	0.1
8	0.0	0.0	0.0	0.0	0.1
10	0.0	0.0	0.0	0.0	0.1
16	0.0	0.0	0.1	0.0	0.2
20	0.0	0.0	0.1	0.1	0.2
25	0.1	0.0	0.0	0.0	0.2
31.25	0.1	0.0	0.1	0.2	0.2
62.5	0.2	0.0	0.3	0.3	0.3
100	0.1	0.1	0.3	0.3	0.4

APPENDIX B: EIA/TIA TSB-40A Compliance

**Table B-3. Results of TSB-40A Compliance Testing, Part 3:
Typical Return-Loss Measurements**

Return-Loss Measurements for the Primary Surge Protector (SP250A)

Freq. (MHz)	Pins 1-2 (dB)	Pins 3-6 (dB)	Pins 4-5 (dB)	Pins 7-8 (dB)	SPEC (dB)
1	27.4	27.6	28.4	28.0	23
4	37.3	38.0	49.0	42.5	23
8	40.8	42.3	37.8	38.7	23
10	39.6	40.0	35.7	35.4	23
16	37.0	34.0	32.3	33.0	23
20	35.0	30.8	31.0	31.6	23
25	34.5	24.4	29.8	30.4	14
31.25	35.0	23.5	30.0	30.5	14
62.5	24.2	28.7	22.0	22.5	14
100	19.0	27.0	18.3	19.0	14

Return-Loss Measurements for the Secondary Surge Protector (SP251A)

Freq. (MHz)	Pins 1-2 (dB)	Pins 3-6 (dB)	Pins 4-5 (dB)	Pins 7-8 (dB)	SPEC (dB)
1	27.3	27.6	28.5	28.0	23
4	38.2	37.2	48.6	42.4	23
8	42.0	40.4	39.4	30.4	23
10	41.4	38.6	36.4	38.6	23
16	38.8	32.7	33.4	35.3	23
20	37.0	28.4	31.8	33.4	23
25	34.9	25.2	30.7	32.2	14
31.25	35.0	22.0	31.4	33.0	14
62.5	27.0	25.3	24.0	25.0	14
100	21.5	25.0	19.8	21.8	14

NOTES



© Copyright 1996. Black Box Corporation. All rights reserved.

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746