

# APPLICATION NOTE

## Why Surge Protective Devices are Essential in Building Electrical Panel Designs



Bourns® Model 1250A Series  
Surge Protective Device



Bourns® Model 1260 Series  
Surge Protective Device



Bourns® Model 1270 Series  
Surge Protective Device



Bourns® Model 1280 Series  
Surge Protective Device



Bourns® Model 1320 Series  
Surge Protective Device



Bourns® Model 1420A Series  
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Bourns® Model 1430 Series  
Surge Protective Device



Bourns® Model 1440 Series  
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Bourns® Model 1500 Series  
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### Introduction

The rising complexity of electrical systems and the growing reliance on sensitive electronics in industrial and commercial applications make Surge Protective Devices (SPDs) a critical specification in electrical building panel designs. SPDs offer powerful protection that engineers can use to safeguard sensitive control equipment by providing the capabilities to help ensure the uninterrupted operation of industrial processes, building automation, and other vital infrastructure systems. Whether protecting AC/DC power lines or data and signal transmission lines, SPDs are essential building electrical control panel design elements that contribute to increased equipment longevity and reliability.

This application note will outline why adding SPDs to building electrical panels is important to maximum uptime and overall reliability. Specific types of panel applications that benefit from SPD protection will also be presented as well as what SPD solutions are best suited for different environments.

### The Importance of Surge Protection in Electrical Panels

Surges, which are sudden and short-term increases in voltage, can be caused by several factors, including lightning strikes, industrial equipment switching, and utility grid disturbances. These voltage surges can damage sensitive electronics and control systems, leading to equipment malfunction, reduced efficiency, or even catastrophic failure. Electrical panels, which house systems like Programmable Logic Controllers (PLCs), Distributed Control Systems (DCSs), Building Automation Systems (BASs), and Supervisory Control and Data Acquisition (SCADA) Systems, are particularly vulnerable to these transient surges. SPDs are designed to serve as the first line of defense by preventing these surges from entering the panel and damaging connected equipment.

## Why Surge Protective Devices are Essential in Building Electrical Panel Designs

### Why SPDs are Needed in Control Panels

#### 1. Protection of sensitive electronics

- Control panels are full of sensitive electronics, such as sensors, transmitters, and controllers, that require consistent and stable voltage levels. Voltage surges can degrade or completely destroy these components.

#### 2. Reduction of system downtime

- Unexpected power surges can halt operations, leading to costly downtime. Installing SPDs helps minimize equipment damage, ensuring that systems remain operational.

#### 3. Compliance with industry standards

- Many standards and regulations, such as UL 1449 and IEC 61643-11, mandate the use of SPDs in certain critical infrastructure and industrial applications to ensure system reliability.

#### 4. Cost savings

- Repairing or replacing damaged equipment is typically far more costly than installing SPDs. Preventing surges from reaching sensitive equipment is a wise investment in long-term operational efficiency.



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### Common Usage of SPDs in Control Panel Applications

1. Distributed Control Systems (DCS), often used in industrial environments such as chemical plants, refineries, and manufacturing facilities, require stable operation for controlling complex processes. SPDs protect DCS from surges caused by switching heavy loads or lightning-induced transients. The Bourns® Model 1420A Series DC SPD provides effective protection for DC power systems that power field devices such as sensors and transmitters, helping to maintain system reliability.
2. Programmable Logic Controllers (PLCs) are the backbone of automation systems in industries like manufacturing, energy, and water treatment. Both the power supply and control circuits of PLC systems require effective surge protection. Bourns® Model 2510 and 2520 Series SPDs are designed to protect data and signal lines that are key to maintaining maximum PLC communication network uptime.
3. Building Automation Systems (BAS) control various building functions such as HVAC, lighting, and security. The integration of multiple subsystems requires stable communication and power, both of which can be compromised by surges. The Bourns® Model 1250A Series provides robust surge protection for AC power inputs, safeguarding strategic automation equipment.
4. Supervisory Control and Data Acquisition (SCADA) Systems are used for the vital monitoring and controlling of industrial processes over large geographic areas, such as electrical grids, pipelines, and water distribution. SCADA systems require protection for both AC/DC power and communication lines. Ideal protection solutions are the Bourns® Model 1420A Series that helps to ensure that DC power feeding critical infrastructure remains stable, while the Bourns® Model 2510 and 2520 Series are designed to protect signal and data lines from transient voltage spikes.
5. Security Systems that involve surveillance cameras, access controls, and alarms depend upon continuous power and reliable data transmission. Surges in these systems caused by external events such as lightning can compromise the operations of the entire system.
6. Fire Alarm System control panels, automatic detectors, and alarm signaling devices require stable power to function correctly. Power surges can disrupt these systems, leading to false alarms or equipment failure. The Bourns® Model 1250A Series SPD is well-suited for protecting fire alarm systems' AC power input. In addition, the Model 2510 Series can be used to protect critical signal lines between detectors and control panels.



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### Selecting the Right SPD

Selecting the right SPD depends on understanding the type of surge exposure, the environment, and the criticality of the equipment being protected. For building electrical panel applications, there are three primary categories of devices that require the level of protection SPDs can provide.

- 1. AC Surge Protective Devices:** Power distribution systems require SPDs for AC line protection against surges. Bourns® Model 1250A Series offers the advanced features to protect AC power in control panels. It meets both UL 1449 and IEC 61643-11 standards and features advanced thermal disconnection for maximum reliability.
- 2. DC Surge Protective Devices:** The power supplies for control systems that run on DC, such as Distributed Control Systems (DCS), PLCs, and sensors need SPDs designed to protect DC power lines. Bourns® Model 1420A Series is engineered to provide robust protection for DC power systems operating in certain harsh environments.
- 3. Signal and Data Line Devices:** Protecting data and communication lines from surges is critical for maintaining system integrity. The Bourns® Model 2510 and 2520 Series provide reliable surge protection for data and communication lines in industrial control systems, SCADA systems, and BAS applications. These UL 497B-certified devices ensure compliance with safety standards and feature a two-stage protection circuit with GDTs and diodes to limit transients effectively. They maintain uninterrupted signal transmission during module replacements, reducing downtime.

#### When choosing an SPD, important considerations include:

- **Nominal Operating Voltage:**  
Confirm the selected SPD is compatible with the specific panel's voltage.
- **Surge Current Capacity (Imax):**  
Select an SPD that can handle the expected surge current for the application.
- **Response Time:**  
Choose SPDs with fast response times to ensure rapid suppression of transients.
- **Compliance:**  
Verify that the SPD meets the required standards, such as UL 1449 for North American markets or IEC 61643 for global applications.

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### Installation Guidelines for SPDs in Control Panels

#### 1. Location of Installation:

SPDs should be installed as close as possible to the equipment they are protecting. For AC power protection, install SPDs at the main distribution board and key branch panels.

#### 2. Wiring Considerations:

Minimize the lead length of the SPD connections to reduce impedance. This helps to ensure that the SPD can effectively clamp surges. Use appropriately rated wiring and follow manufacturer guidelines for grounding and bonding.

#### 3. Proper Grounding:

Make sure the system has a reliable grounding system. Poor grounding can severely limit the effectiveness of the SPD.

#### 4. Protection Coordination:

For comprehensive protection, consider installing SPDs at multiple points within the system: at the service entrance (primary protection), distribution panels (secondary protection), and the end equipment (tertiary protection).

### Certificates and Standards for SPDs

When selecting an SPD for building electrical panel designs, designers need to understand the relevant compliance standards for the geographical location or type of system:

- **UL 1449 (5th Edition) for North American markets**
- **IEC 61643-11 for European and international markets**
- **IEC 61643-31 for DC and photovoltaic systems**

Adherence to these standards is required so that the SPD provides reliable protection against surges, meets performance benchmarks, and passes stringent safety tests.

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### Application Example

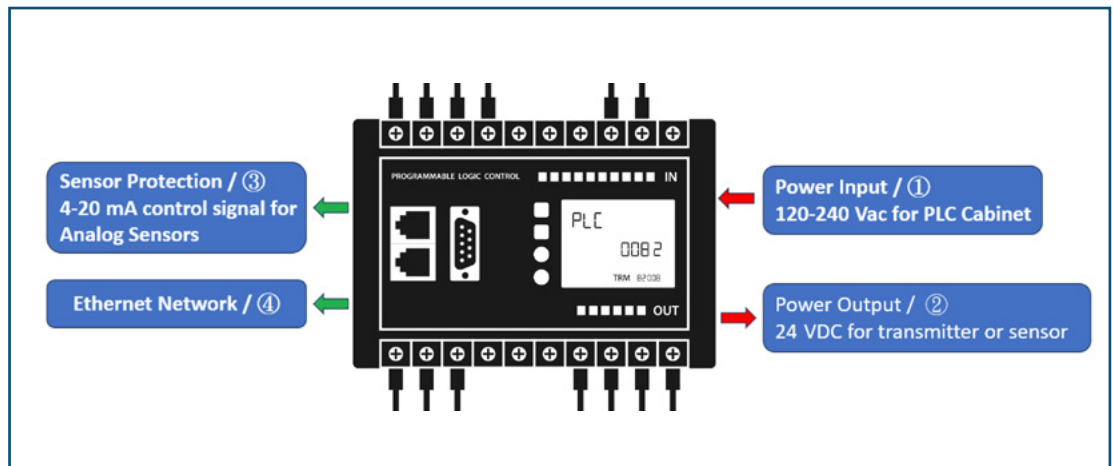


Table 1. | Bourns® SPD Model Series for Programmable Logic Controller Cabinet

Key Components / Location	Function Description	Suggested Bourns® SPD Series
<b>1. Power Input 120 - 240 VAC for PLC Cabinet</b>	Provides AC power to the entire PLC cabinet and connected devices. It requires protection from high-energy surges to ensure continuous operation.	1250A Series 1260 Series 1270 Series 1280 Series
<b>2. Power Output 24 VDC or 48 VDC* for Transmitter or Sensor</b>	Supplies 24 VDC (or 48 VDC) power to transmitters, sensors, and other field devices. Protects sensitive DC power lines from transient surges, ensuring reliable operation of field devices.	1320 Series 1420A Series 1430 Series 1440 Series
<b>3. Sensor Protection 4 - 20 mA Control Signal for Analog Sensors</b>	Protects control signal lines carrying 4-20 mA analog signals from surges, ensuring accurate sensor readings.	2510 Series 2520 Series
<b>4. Alarm Signaling Devices</b>	Provides surge protection for Ethernet-based communication networks, shielding sensitive data transmission from transient surges and network disruption.	1500 Series 1530 Series 1540 Series

\*24 VDC is acknowledged as the more common option, while also allowing for 48 VDC in certain setups, especially in environments where higher power or telecommunications equipment is involved.

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### Conclusion

In modern industrial, commercial, and infrastructure environments, SPDs are an indispensable part of any control panel. They are vital to helping ensure that sensitive control equipment is protected from damaging surges, thereby reducing downtime, minimizing the need for costly repairs, and enhancing operational safety. Whether for AC or DC power protection, or safeguarding data and signal lines, Bourns offers a comprehensive range of proven SPD products engineered to help building electrical panel designers maintain reliable, efficient systems. By installing SPDs at critical points throughout the electrical panel, developers are able to implement a long-lasting protection solution that enhances critical system integrity.

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