BOURNS®

Front-end Protection for 3-phase Uninterruptible Power Supply (UPS) Systems

APPLICATION BRIEF

Situation

Uninterruptible Power Supply (UPS) systems are critical infrastructure found within data centers, medical equipment*, and other high-value needs. These devices act as an intermediate stage between the connected load devices and the electrical grid. They ensure that the incoming electricity is clean and stable, as irregularities and unwanted signals can be present within the power grid. UPS devices do so by integrating switch-mode power supply topologies and battery management systems used to buffer incoming electrical grid power from irregular or blackout power conditions.

UPS systems also integrate overvoltage and overcurrent protection to further add protection against irregularities from the AC grid. In these cases, the UPS must dissipate or divert the incoming overvoltages or overcurrents. Bourns, a leading manufacturer of circuit protection devices, recommends the usage of their hybrid IsoMOV® Hybrid Protectors, discrete MOVs and GDTs, high-power fuses, and catalog of resistors. This application brief will outline the usage and recommendations of Bourns solutions in UPS circuit protection.

Solution

- IsoMOV® Hybrid Protectors are Bourns solution to general power protection. They are a symbiosis of Metal Oxide Varistors (MOVs) and Gas Discharge Tubes (GDTs), providing the devices with the benefits of both technologies. These devices are as flexible as they are powerful, and a strong choice within a UPS system.
- Much like the hybrid offering, Bourns® Discrete MOV and GDT products are also available in several voltage and current ratings to give designers ultimate flexibility when designing a front-end protection schematic.
- High-power fuses ensure safe and reliable operation in the event of overcurrent events. Fuses are commonly used to break circuits under short circuit or overload conditions to prevent potential fire hazards.
- Resistors are as flexible as they are reliable. Bourns highlights two use cases of them inside the front-end of a UPS device: current sensing shunts, and voltage dividers. High-power shunts are used within current sensors because they allow for precise current measurement. They are low resistance resistors that are built with low tolerances and high precision, while voltage dividers require high resistance resistors that allow for low noise voltage measurements. These two systems provide accurate diagnostics and power management information.

Benefits

Enhanced Surge Protection: IsoMOV® Hybrid Protectors combine the fast response of MOVs with the robustness of GDTs, offering superior protection against transient overvoltages and minimizing wear over time.

Bourns® discrete MOV and GDT solutions deliver strong surge protection with design flexibility, extending UPS system reliability and safeguarding sensitive electronics from damaging transients.

- **Improved System Reliability:** High-power fuses localize damage during fault conditions, preventing widespread system failure and reducing downtime.
- **Precision Monitoring:** Bourns® resistors enable accurate current and voltage sensing, allowing UPS systems to detect and respond to irregular power conditions effectively.
- **Design Flexibility:** The wide range of Bourns® resistors supports multiple configurations, including current shunts and voltage dividers, tailored to specific UPS front-end requirements.
- **Cost-Effectiveness and Safety:** Using fuses simplifies repairs and lowers replacement costs while preventing potential fire hazards, making UPS systems more economical over their life cycle.
- **Trusted Quality:** Bourns' reputation for high-performance circuit protection components ensures long-term durability and compliance with industry standards.

**Bourns® products have not been designed for and are not intended for use in "lifesaving," "life-critical" or "life-sustaining" applications nor any other applications where failure or malfunction of the Bourns® product may result in personal injury or death. See Legal Disclaimer Notice: www.bourns.com/docs/legal/disclaimer.pdf*

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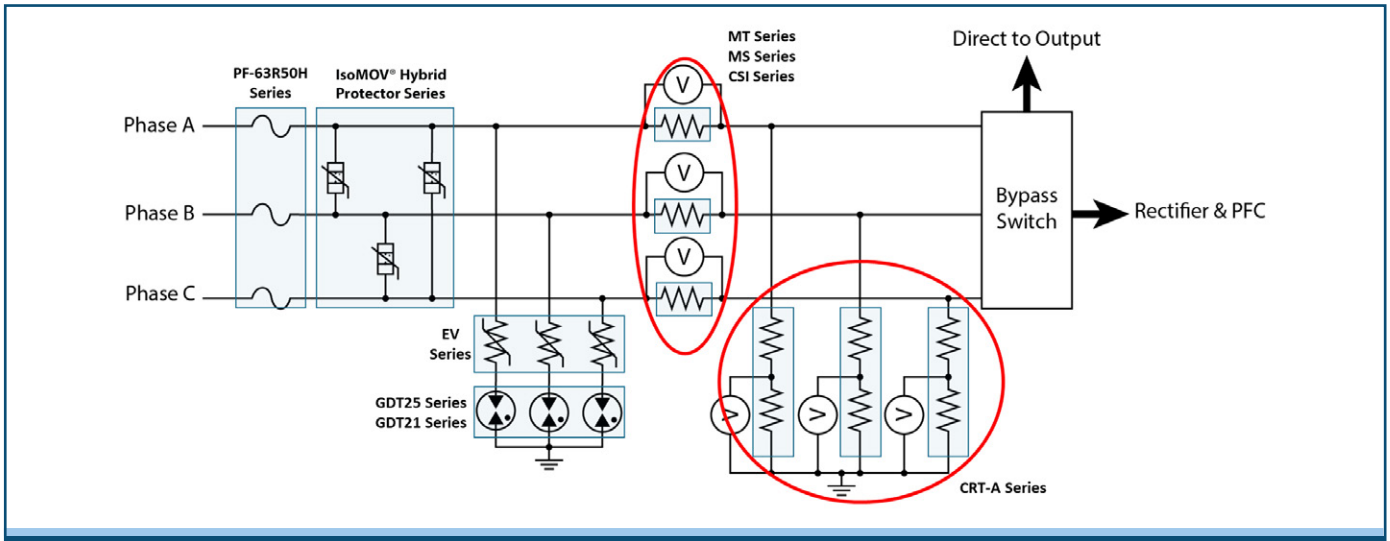
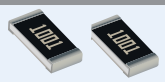


Figure 1. | *Circuit Protection Diagram of the Front-end Protection for 3-phase UPS Systems*

Overvoltage and Overcurrent Protection

Product Image	Recommended Products	Specifications & Features
	IsoMOV® Hybrid Protectors	• Max. Voltage: 175-555 VAC • Max. Peak Current: 6-15 kA, 8/20 µs • Operating Temperature: -40 to +125 °C
	EV Series Varistors	• Max. Voltage: 150-550 VAC • Max. Peak Current: 2.5-15 kA, 8/20 µs • Operating Temperature: -40 to +105 °C
	GDT25 Series Gas Discharge Tubes (GDTs)	• Breakdown Voltage: 75 – 600 VDC • Max. Peak Current: 10 kA, 8/20 µs • Operating Temperature: -55 to +125 °C
	GDT21 Series Gas Discharge Tubes (GDTs)	• Breakdown Voltage: 150 – 600 VDC • Nom. Peak Current: 500 A, 8/20 µs • Operating Temperature: -40 to +105 °C
	PF-63R50H Series POWrFuse™ High-Power Fuses	• Rated Voltage 500 VAC • Rated Current: 10-40 A • Interrupt Rating: 30 kA

Current and Voltage Sensing Protection

Product Image	Recommended Products	Specifications & Features
	CRT-A Series Thin Film Shunt Resistors	• Resistance Range: 10-1M Ω • Temperature Coefficient: ±10-50 PPM/°C • Max. Power: 63 - 250 mW
	MT Series Wirewound Shunt Resistors	• Resistance Range: 3-100 mΩ • Power Rating: 1-10 W • Tolerance: 0.1 - 5 %
	MS Series Bare Metal Element Resistors	• Resistance Range: 5-100 mΩ • Power Rating: 1-5 W • Tolerance: 1 - 5%
	CSI Current Sense Shunt Resistors	• Resistance Range: 0.2-5 mΩ • Power Rating: 1.5-15 W • Tolerance: 1 %, 2 %, 5 %