

Switch-mode fold-back prevention helps find faults faster

When a chafed electrical wire caused a 24Vdc switch-mode power supply to 'fold-back' at Solid Energy's Huntly East Mine, mine electrician Tim Fleming had to find the fault and fix it fast to minimize lost production.

While 'fold-back' prevents serious electrical damage to switch-mode power supplies it often results in a complete shutdown of PLC control systems which can bring production to standstill as it did at the mine.

Unfortunately for Fleming the very nature of switch-mode power supply fold-back makes fault finding difficult and time consuming because there is seldom any indication of where or how the fault occurred.

The situation becomes even more intolerable when the electrical fault is intermittent, making fault-finding time consuming and expensive.

This, says Fleming, was the scenario that confronted him at the Huntly East Mine and says the frustrating thing was that the switch-mode power supply appeared to be functioning normally.

"You could say the lights were on but nobody was at home."

Fleming says it was a full and excruciating two hours before he was able to trace the fault to a chafed cable that had earthed



Stewart Blake (right) of Kiwi Control Systems solved fold-back issues at the Huntly East mine with Waveguard power supply protection from Weidmuller, thanks to the timely help of Geoff Thomson of CSL (left)

causing a proximity sensor on a conveyor to fail which in turn caused the switch-mode power supply to fold back.

He says owing to switch-mode design, 24Vdc power supplies cannot supply dynamic output current or, at best, supply very limited current which means that in the event of an overload the power supply automatically reduces voltage output causing fold-back.

Reduced voltage means there is insufficient power to trip circuit breakers or cartridge fuses which Fleming says is often the first place you'd look for clues as to where the fault has occurred.

Waveguard electronic fusing

When Solid Energy switchboard builder Kiwi Control Systems Ltd project engineer Stewart Blake heard about the problem he knew a solution was close at hand.

Blake says he'd only recently discussed fold back issues with Cuthbert Stewart's industrial field operations manager

Geoff Thomson who had recommended Weidmuller's Waveguard electronic fusing as a cost-effective solution.

Blake says at that time Kiwi Control Systems was building two new conveyor starters for the Huntly East Mine and at Thomson's recommendation fitted Waveguard units even though these had not been specified in the original design.

"We were happy to absorb the cost on this occasion so that Solid Energy could see the practical benefits of Waveguard fusing and to ensure the problem did not occur again. For a few hundred dollars Waveguard electronic fusing is cheap insurance compared to the cost of lost production."

Blake says Waveguard modules are now standard on all underground switchboards that they are supplying to the mine to ensure DC supply integrity.

He says Waveguard is useful in a mining environment and similar applications where faults can occur a long way from a ground-level control room.



CSL offers a full range of Weidmuller modular power supply, Ethernet and connectivity solutions as seen in this Solid Energy panel

Thomson says Waveguard works in a similar manner to a standard circuit breaker or cartridge fuse but does not rely on a high output current to trip breakers or fuses.

“Waveguard provides an ultra-fast electronic response to a sudden rise in current and protects individual loads just as a fuse does without affecting other devices powered by the same supply.

“Waveguard selective electronic fusing also eliminates detrimental cross-coupling between parallel current paths and therefore protects and switches off only the defective circuit or circuits.

“This results in high system availability in the event of a fault. It takes the guesswork and expense out of troubleshooting which can be prohibitive in ever more complex PLC systems and networks.”

While Waveguard provides protection it doesn’t delay production restart. Once the cause has been identified the Waveguard module can be reset manually or remotely using a voltage pulse. Module status is verified via an integral LED and separate relay contact that allows remote monitoring from a central PLC control room.

Waveguard is available in five modules ranging from 1.6A to 8A fixed settings and includes an adjustable module with nominal current output ranging from 0.5A to 5A.

Each module comes packaged in Weidmuller’s Wave series housing and mounts on standard TS35 DIN rails with both



Weidmuller’s Waveguard senses a sudden rise in current, trips before fold-back or current limit occurs and isolates the faulty circuit

screw or tension clamp plug/socket terminals.

Parallel switch-mode and redundancy

Fitting parallel switch-mode power supplies is a fact of life as increasing system demands exceed existing capacity, but how you parallel power supplies is critical to reliable switch-mode performance.

Unless you match the 24Vdc output levels to within millivolts of each other and use exactly the same gauge and length of wiring, parallel switch-modes are unlikely to balance correctly and one will simply take over causing fold-back issues.

“Incorrect parallel connectivity can create more problems than it solves and faults arising from it can be difficult to diagnose. But there is a simple, fail-safe and cost effective solution utilising Weidmuller’s Ecoline diode modules,” says Thomson.

“These not only ensure that both power supplies operate correctly in parallel and share the load via the module but they will also supply full output power should either parallel switch-mode fail.”

This redundancy makes sure power supply is delivered to loads, which is essential in manufacturing and processing to protect complex systems’ data.

“Diode module installation is as simple as connecting the 24Vdc outputs of each power supply to the input terminals of the diode module. A single output is then available from the load side of the diode unit. This configuration means there is no chance of the power supplies affecting each other’s output.”

Thomson says in critical applications Weidmuller’s ConnectPower 300 W power supply achieves load sharing and redundancy without relying on a separate diode module. Power supplies are instead linked by a shielded two-core comms link for mutual monitoring and all parameters are self-checked and controlled via this connection.

ConnectPower allows up to five 12.5A power supplies to be connected in parallel for increased load capacity (up to a maximum of 62.5A), load sharing and redundancy options. In load sharing mode the load is split between each power supply and in redundancy mode one power supply



The Ecoline power supply and diode module range share the same rugged din rail housing

provides the power with the other supplies on stand-by should there be a fault.

ConnectPower features analogue outputs for remote monitoring of temperature, current and voltage providing real-time systems analysis on critical circuits.

Complete Weidmuller range

The Ecoline range offers single and three-phase supply options from 72W 3A current output right up to 960W 40A.

Features include a small footprint, robust metal housing, LED power indicators, adjustable 24-28Vdc for voltage drop compensation, remote status alarm and up to 50 percent overload protection and auto-restart functionality.

“In applications where voltage drop is an issue Weidmuller’s Instapower single phase switch-mode power supplies provide easy management with four modules providing trimpot variable outputs for all voltages ranging from 3V to 55Vdc.”

Thomson says Weidmuller power supplies have internationally recognised approvals endorsing their suitability for use in mechanical engineering, industrial automation, systems engineering and the power supply industry. ■

For technical information and application literature contact
Cuthbert Stewart Ltd
 Ph: 0800 CUTHBERT (288 423)