Check your teeth and see your engineer regularly.

Tri-M Systems' Voltage - September 2006

Successful surface-mining operations are a model of efficiency. The pit is usually a bee-hive of activity with trucks, shovels and crushers all moving in a synchronous ballet, orchestrated by operations to generate maximum profit and minimum waste. Unforeseen downtime is not an option and neither are unsafe practices. Quotas and safety standards are set and equipment must be constantly maintained to ensure fluidic operation and a safe working environment.

Malfunctioning engines and broken parts are an operations manager's worst nightmare. Mechanics perform routine maintenance inspections to decrease the probability of an unexpected delay, but items like broken bucket teeth on a shovel are hard to predict or even notice. If tossing a 14 oz hammer into an active crusher will stop the line, imagine the chaos when a broken 100-lb tooth inadvertently finds it's way into the system.

When Motion Metrics International decided to address the unique needs of the mining community they quickly turned to partners like Tri-M Engineering for assistance. Hard work and engineering prowess converged seamlessly with the introduction of the ToothMetricsTM system in 2001. Motion Metrics had defined the market with a creative system that instantaneously warns an operator of the potential loss of a hardened steel tooth from their shovel.

A generic overview of the system reveals a smart, simplistic approach that almost masks the complexity of the solution. The ToothMetricsTM system utilizes a compact camera, attached to the shovel boom where it has an unobstructed view of the bucket. The embedded computer system and LCD touch screen mounted inside the cab use the image from the camera to constantly monitor the status of the bucket, giving the operator an audible and visual alert the second a missing tooth is detected. When the warning is issued, the operator performs a visual confirmation of the failure. If a loss is confirmed, the dump truck now holding the missing tooth can be advised before the payload is delivered to the crusher. With the timely warning from the ToothMetricsTM system, the payload with the missing tooth is diverted into a waste pile, keeping the broken tooth from being introduced into the system and preventing hours of unnecessary downtime, thousands of dollars worth of damage, and most important of all, a potentially life threatening safety issue.

As the ToothMetricsTM system is broken down to its essential components, the complexity of the individual elements become more apparent. As you can imagine, the harshness of the work environment played a huge factor in the overall design process. It was obvious that the constant pounding of metal against rock would cause havoc with even the heartiest of systems, so it was imperative that Motion Metrics start with an enclosure capable of withstanding the severe beating it would encounter 24-hours, non-stop, every day. Tri-M Engineering provided the answer with their durable VersaTainerTM enclosure system, specifically engineered to withstand the repetitive forces projected by the Motion Metrics design team. The VersaTainerTM is formed from rugged anodized aluminum, with isolating shock mounts and an internal stack vibration mount. The VersaTainerTM is a perfect choice for the ToothMetricsTM application as it provides maximum protection from both high frequency vibrations and low frequency G-forces, as well as passive heat dissipation and protection from the copious dust and moisture found in this extreme environment.

Tri-M Website

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With the system now safely enclosed, it was time to tackle the power requirements. Reliability and size were two key factors in the choice of a power supply for the ToothMetricsTM system, so Motion Metrics again turned to Tri-M Engineering for help. The versatile HE104-DX is a 60 watt powerhouse that provides a 95% efficiency rating while maintaining an extended temperature range of –40oC to +85oC. Utilizing the compact PC/104 format, it was the perfect combination of size and power for the project.

The bucket can be observed in real time by both the in-cab display monitor, as well as a screen located in the operations control room via a wireless network. The display shows the overall image of the bucket as well as a status indicator for each individual tooth. The system will hold past images for future reference, and is easily calibrated for each individual mining application. The user interface is not language based so it's easily interpreted, and drivers have the option to choose from several display modes so they can customize their set-up to suit their comfort level.

Since it's inception the ToothMetricsTM system has saved operations across the globe hundreds of thousands of dollars in equipment replacement costs and lost man hours, and has improved safety in the mine. Along with a number of associated products, including LoadMetrics, FragMetrics and ViewMetrics, Motion Metrics International has obviously gone the extra mile when it comes to creating unique solutions for a hard working industry segment.

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