

Conveyor Management System

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Management is a term, which is generally related to the direction and administration of people. However in today's atmosphere of corporate downsizing and restructuring, a person in a management position has, or likely will have, his resources redefined. In the past, a plant manager had at his disposal a multitude of departments; each with several individuals trained to perform any number of duties. Today, a plant manager's success is often gauged by his or her ability to react to problems with limited resources. Realizing that profit is only possible with production, it is the ultimate responsibility of management to insure that production is maximized. With the current trend being more with less, it is only natural that more is expected from each piece of equipment within the production cycle.

In most industries, production begins with a product in a bulk form. Whether the final product produced is aggregate or gold, it is most often transported at some phase by a conveyor. Therefore the overall importance of conveyor systems in the production of most materials is paramount. A conveyor is an asset, which must be properly managed in order to achieve maximum performance.

It was mentioned earlier that a manager is often judged by his ability to REACT to problems with limited resources. Consider how much more effective a manager could be if a system was utilized which would manage the safety switches, monitoring switches, and control of the conveyor and related devices, while providing all information in a user friendly format.

With the technology available in the sensor industry, many potential problems or component failures can be predicted, or at least detected, before major damage is caused. With proper sensor selection and location, a conveyor can be protected from most damage which could result in extensive downtime.

In most "Automated" plants there are several Programmable Logic Controllers (PLC's) which are used to monitor a multitude of switches, as well as to serve control functions. The PLC is a very powerful and flexible device, however it must be individually hard wired to the devices which it will monitor. In the case of conveyors, this requires a large number of wires, which must be installed in conduit, to interconnect the field devices to the PLC. For this reason, installation costs often over shadow the benefits gained.

An additional consideration when dealing with the installation of safety switches, such as pull cord switches, is the hardwire circuit which must exist between the motor starter and the safety switch. In other words, even though the PLC will identify the tripped device, the motor must be stopped by an independent hard wire circuit (figure 1). Specifically, one normally closed contact from each switch is connected to the PLC directly, for identification, and another normally closed contact completes the circuit from the control voltage to the holding contact of the motor starter, to stop the conveyor.

Although the first consideration is often the up-front cost of installation, it is also important to consider the ease of operation and repair. A system that is easy to operate but difficult to install, or conversely easy to install but difficult to operate, may not prove to be a justifiable expense. Cost must be considered not only in terms of the actual dollar spent for the system, but also in the time and effort required to actually implement it.

Conveyor Management System:

As is evident, what appears to be a simple interface between field devices and a control unit can become an enormous amount of wire and conduit. The Conveyor Management System (CMS) provides the solution to the problem of interconnecting the plant control system with the field devices, while maintaining a hardwire connection with the conveyor switchgear.

Utilizing a special communications protocol, an unlimited number of devices are able to report to the control unit through a single conductor. Therefore, the dedicated wires running from each individual switch to the PLC is replaced by a single conductor which forms a continuous network interconnecting each switch to the Head End Control Unit (HECU).

In addition to providing fault location and identification, the CIVIS maintains a hard-wired circuit between the safety switches and the motor starter through the use of the *SafeLine Circuit*. The CIVIS system utilizes a *SafeLine Circuit* as a means to both provide the hardwire interface and to insure that the entire safety switch network is operational. The *SafeLine Circuit* uses a voltage-inverting device, which transmits negative voltage from the last switch in the line, through a normally closed contact in each switch, to the control unit. The negative voltage, upon reaching the control unit, powers a fail-safe contact that energizes the coil of the motor starter allowing it to run.

We have now replaced countless dedicated conductors with four conductors; one conductor for the digital communication, one for the *SafeLine Circuit*, and two for a source of power. In order to facilitate installation, as well as to eliminate the cost of hard wire and conduit, we provide the necessary conductor surrounded with steel braiding. Through the use of the termination kits, we

are able to physically interconnect the switches, utilizing the required conductors in a dual role as the emergency stop pull cord. By utilizing a required element, such as the emergency stop pull cord as a means to route the network cable, we have eliminated the entire cost of electrical installation.

One additional safety requirement on all conveyors is a pre-start warning alarm. Within each pull cord switch is a pre-start warning alarm which is controlled by the HECU and powered by the pull cable. The CIVIS system provides a foundation for all conveyor monitoring and control through the use of the most basic of all electrical conveyor components.

Although installation cost is of great importance to the up-front economics of any equipment, as previously mentioned, the system must be designed so that it is easy to operate. The heart of the CIVIS system is the Head End Control Unit (HECU). The microprocessor of the HECU interprets the digital information from each switch, as well as providing the hardwire interconnection between the safety switches and the motor starter.

Once a fault is detected, it is displayed on the LCD display by customer-specified name and location. By utilizing a clear text description of the fault, the problem can be quickly located and corrected. In a fault condition, the display provides both the total number of trips on the line is displayed, as well as displaying each specific trip in a scrolling mode. All the information from the HECU can also be relayed to a central control room for remote monitoring and logging of all fault conditions. In plants which utilize PLC's, the total amount of I/O required is minimal because the HECU provides the interface with the switches and communicates to the PLC by Binary or BCD mode. In addition, the control circuitry interconnects the *SafeLine Circuit* conveyor switchgear to complete the hard wire circuit between the safety switches and the conveyor motor.

The final consideration of new equipment must be repair. In order to facilitate repair, all boards are fitted with pluggable terminal strips for simple field replacement. However, before repairs can begin, damaged components must be located. If a component is damaged or malfunctioning, the self-diagnostic HECU will identify the problem to within two pull cord switches, further eliminating downtime to search for damaged components. All PC boards are additionally equipped with fault LED's to further localize problems to component level repair.

By judging the Conveyor Management System on the basis of cost versus benefit, it is clear that this system is able to truly provide more for less. By providing the design criteria necessary for ease of installation, operation, and repair, it is both the logical and economical solution to the problem of communication between field sensors and the control room.

With the clear purpose of the Conveyor Management System being to minimize downtime, it is a

tool that no manager can afford to do without.

