CAN communication with fiber optics

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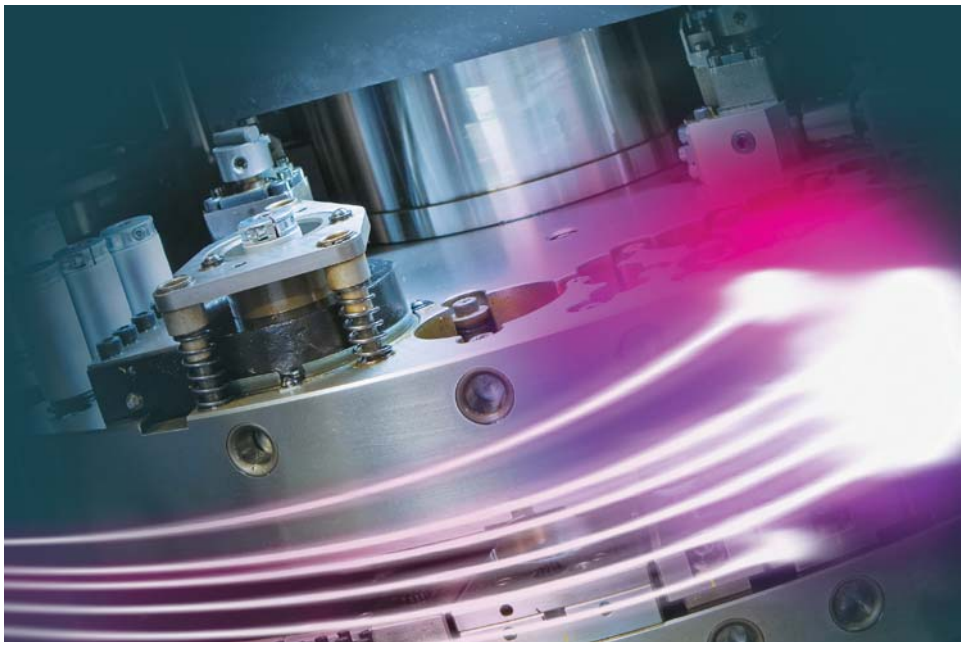

Figure 1: Punching machine using fiber optics

Summary
With fiber optics the performance of CAN networks may be increased. The D-Light CAN converter systems by EKS Engel may connect two CAN nodes across distances of up to 100 km and transmit data with bit-rates of 1 Mbit/s. Apart from that, the "FiberView" system allows monitoring the fiber optic path continuously. Thus, reliability and permanent access to machines and other units is guaranteed.
Fiber optics offers a range of advantages for use in CAN networks, above all transmission across long distances, high data transmission rates and a maximum of security.
Active components for rough industrial environments are commonly offered.

Since fiber optic cables consist of electric, non-conductive material, data is always transmitted by an electric insulator. This eliminates potential equalization currents that are a particular cause of concern in extensive networks. Even in case of lightning there is no risk of damage for the network devices. Compared to twisted pair cables, fiber optics needs no grounding or additional shielding. Since light is not influenced by electric or magnetic interferences, fiber optics can be installed right next to power lines or other electro-magnetic sources.

Regarding prices there is no real difference between twisted pair and fiber optic cables. Nevertheless, 1 kg of fiber optics is as powerful as 1000 kg of copper. Finally, the resource balance speaks for itself: Copper is too valuable to install it in terms of cables. Fiber optics, however, consist of silicate, which is available almost indefinitely. This also applies to the raw material of fiber optics, which are made of plastic.

Single-mode fibers transmit data across distances of up to 100 km. For shorter distances (up to 5 km) multi-mode fibers are a cost-efficient alternative. There are, in fact, cables, which are delivered with connectors and attenuation protocol already, but this is only recommendable if the cable lines are easily accessible and not longer than 300 m because it must be possible to unroll the cable. For distances up to 50 m, POF (Polymer Optical Fiber) cables are a useful alternative. They are real plastic fibers, which can be connected without any special tools – a sharp knife and fine-grained sandpaper are enough.

Apart from that, professionals should assemble the connectors and measure the attenuation on site afterwards. This – unlike pre-assembled versions – avoids the risk of damaging a cable during assembly and ensures that the infrastructure is working properly.

CAN transmission

D-Light CAN converters by EKS Engel change electrical CAN signals into optical signals and are suitable for point-to-point, line or redundant ring structures. Apart from multi-mode and single-mode fibers, POF fibers can be used as well. Furthermore, it is possible to have mixed optical-electrical structures.

Figure 2: D-Light CAN converter for changing electrical into optical signals

As the converters work on the physical layer, the systems using different protocols based on CAN (e.g. CANopen or DeviceNet) may be supported and can be cascaded optionally. It is possible to have various connector types on the device such as ST, SC, SMA or E2000. For single-mode and multi-mode fibers there is also an SC connector that supports BiDi-technology (bidirectional), i.e. a communication in two directions via a single fiber.

For the data transmission, the converters provide a budget (difference between trans-mission power and receiver sensitivity) that bypasses the attenuation depending on the fiber optic cable. The attenuation, however, often increases step by step due to loose connecting components, dust and dirt, light incidence, mechanical conditions or changes in network topology. Up to now this could only be recognized by complex measurements such as optical time-domain reflectometer (OTDR). "FiberView" is a monitoring system that was especially developed for this kind of task. It consists of a hardware/software combination that is integrated into the active components and monitors the budget of the fiber optic path per port. The introduced fiber optic converters provide this monitoring system. The LEDs at the front show if the budget is OK (green), limited (yellow) or insufficient (red). If the yellow LED flashes it is just below the selected system reserve of 3 dB. Since this pre-warning level is additionally indicated via a potential-free contact it can also be evaluated in SCADA-systems. In contrast to status updates, which might often be misinterpreted, the "traffic light" principle is generally understandable. Furthermore, the yellow status allows the user to plan his action in a more foresighted way; for the attenuation is not yet too high, i.e. the fiber optic paths is still working. However, service and maintenance work should already start in order to avoid any network breakdowns. Thus "FiberView" helps increasing productivity and reducing costs. ◀