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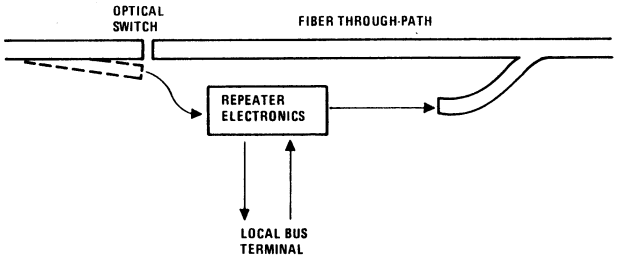
Fail Safe Fiber Optic Repeater Demonstrated in Joint Project

The recent demonstration of a fail safe repeater for fiber optic bus application is an example of multi-divisional technology innovation. The history of this project is interesting because it allows insight into the creative process as well as a glimpse of new technology with wide Honeywell systems application. Fiber optic repeaters are, as one might guess, devices to detect, amplify and retransmit optical signals. The "fail safe" repeater allows light to detour electronic failures. This permits operation of a digital data bus with repeaters in series even if a number of the repeaters have failed.

This project was unusual because it involved critical contributions by four Honeywell organizations, SRC, CTC, TSC and OED (Optoelectronics Division). It was informally managed on a shoe-string budget, and took about two months from kickoff to demonstration.

In late October 1981 in a fiber optics planning meeting in Dallas, a number of the participants decided that a fail safe fiber optic repeater was important for Honeywell and that it was now feasible to design a laboratory prototype. Basing plans on an optical switching concept suggested by Bob Biard for OED; SRC, TSC and CTC scientists in the Dallas meeting decided to attempt building a demonstration model by the end of the year. CTC was to develop special fibers for the switch, TSC handled electronics issues, and SRC took charge of optical fabrication.

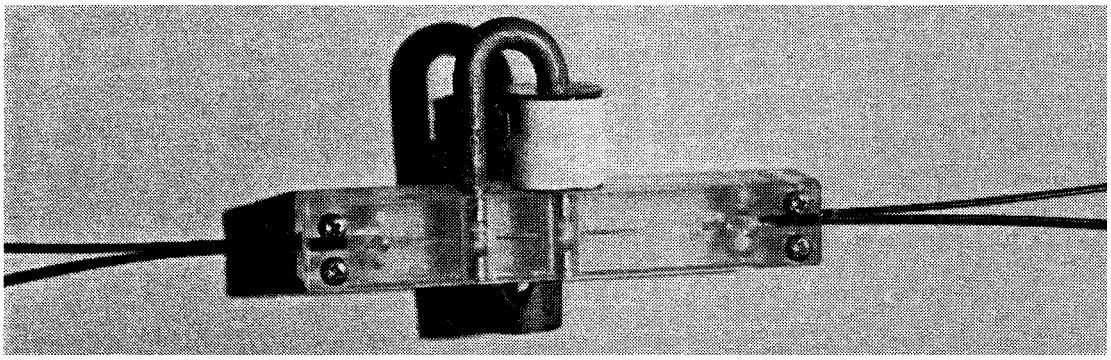
Participants were motivated by the technical challenges they faced and also by an understanding of the potential usefulness of these repeaters. In fiber optic data bus systems high bandwidth, immunity to electro-magnetic interference and long distance transmission can be achieved. To take advantage of these inherent fiber system features it is necessary to configure the system to suit user needs. The most convenient system architecture in many cases is similar to a telephone party line.



The optical switch in a fail-safe fiber optic repeater allows defective components to be bypassed.

This architecture allows one to easily tap into an existing line to add bus terminals. Unfortunately, every additional user depletes the light in the fiber. The obvious remedy of regenerating the optical signal with a repeater can only be applied where reliability is not a problem. For ADG and many other Honeywell applications bus operation must, however, be maintained despite component or power failures. Having a fail safe repeater in these situations allows taking advantage of attractive bus architectures and operating with high system reliability.

As he looks back at the project, Gordon Mitchell, SRC participant, cautions that one cannot conclude that short schedules, low budgets and inter-organizational projects are the path to technical success. This project had a significant probability of failure; success was a result of breakthroughs which were not foreseen at the outset. For example, Al Haggerty (TSC) and Bob Dahlgren (SRC) developed a fiber alignment scheme which coupled light through the optical switch with less than 10% loss; Anis Husain (SRC, now with TSC) designed easily fabricated fiber power combiners for the repeater output stage; John Skogen and Ben Hocker (CTC) provided large core optical fiber coatings.



Second-generation optical switch