

ARCNET Plays Integral Role in Postal Sorting Machines Across the United States

A Lockheed Martin business unit, Distribution Technologies in Owego, New York, was facing a network challenge. It needed to replace an existing serial port network used to control postal sorting machines with a high-speed network.

Distribution Technologies chose ARCNET embedded networking technology to serve as a communication backbone in coordinating all the machine's functions. ARCNET provided the required coordinated machine control, while meeting cost and performance objectives of the project. It was critical to the project that a real-time operating system such as QNX be used.

Known as one of the leaders in ARCNET equipment, Contemporary Controls was contacted by Lockheed Martin Distribution Technologies to supply the required network interface modules (NIMs) and fiber optic active hubs.

According to George Karones, one of Contemporary Controls' Senior Engineers, ARCNET was a cost-effective solution to upgrade the postal sorting machines and meet the project's overall design specifications. Karones said the machine's mechanics were not altered; however, the controls were changed without disrupting existing cabling.

"ARCNET satisfied the requirements," said Karones. "The project required compatibility with the existing machinery's built-in fiber optic cabling as well as 'bolt-on' modularity with a high level of integration to minimize system downtime."

Because of its small size, PC/104-style bus cards were chosen and Contemporary Controls provided the required PC/104 ARCNET fiber optic NIMs for each control system.

In the operation of the postal sorting machines, ARCNET offered significant benefits over the control equipment being replaced. Karones cited several inherent advantages that had improved the equipment's performance.

ARCNET's high 2.5 Mbps data rate, which was a considerable increase in speed witnessed by Lockheed Martin engineers over the older serial port approach, yielded quick responsiveness to short messages and much faster downloads. ARCNET's real-time deterministic token-passing protocol was well suited for synchronizing all the machine's moving motors and belts in a predictable fashion. On-time delivery was also guaranteed.

ARCNET functioned with no difficulty over the fiber optics (the blood vessels of the machines). Another important advantage included ARCNET's immunity to electrical noise and electrostatic discharge generated by the sorting machines. Contemporary Controls' PC/104-style ARCNET cards interfaced with the existing SMA-style fiber optic connectors, linking a single master device called the boot server to 15 diskless stations. Upon power-up, all diskless stations were quickly loaded by the boot server. The company's MODHUB-16 fiber optic active hub facilitated connections to all the stations.

Whereas many other systems require layers of software to operate and talk over the network, diagnostic functions such as error checking, flow control and network configuration were done automatically by ARCNET without software intervention. For these reasons, ARCNET is an ideal embedded networking technology.

ARCNET is directly supported by each machine's QNX Software Systems' real-time operating system. It allowed for one centralized server location to store all the processes so any configuration changes were automatically directed to the individual computers located along the postal sorting machine. The real-time control of both ARCNET and QNX provided cost-effective performance.

Sorting machines are located in major postal distribution and processing (P&DC) centers throughout the United States. Each machine is nearly 150 ft. long and has three key functions: induction, transport and delivery. Each induction station and the eighth, 12th and 16th delivery bins are computer controlled for a total of 16 computers distributed throughout the machine. One PC/104-style ARCNET card is equipped in the boot server and one in each of the diskless computers. Connection to the network is through the machine's existing fiber optic cabling.

Within the induction station the parcels drop down onto the belt and the zip codes are keyed in either by the bar code reader or a human operator. The parcel has now been inducted into the machine's process. The control system understands the parcel has a zip code, which will determine where it will be delivered, and makes a note of the parcel's destination.

The induction stations feed a long transport belt comprised of individual cells. The parcel moves along a series of conveyor belts until it is synchronized to the transport belt and directed into one of these cells. The control system sends a message to an output module that controls the destination bin. The module monitors passing cells, and parcels are dropped into correct bins based on destination. This modular architecture allows the machine to be configured per the mail volume of the facility.

For Lockheed Martin's embedded application, ARCNET succeeded in both cost-savings and functionality — Contemporary Controls' networking component was the key for a practical and successful implementation.