

DATA LINKS FOR INDUSTRIAL CONTROL

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COMPUTERS used in factories often must communicate with one another. Examples include control computers exchanging messages about parts moving down an assembly line, and microcomputers relaying pressure or temperature readings to a process-control computer located perhaps a quarter-mile away.

Unfortunately, computer data links from different manu-

If two computers are made by different manufacturers, they may not be able to communicate with each other. The problem—a lack of pervasive interfacing standards—is particularly acute on the factory floor, where large computer networks often must exchange data. But new rules for data links and network control promise to correct the matter.

facturers are generally incompatible. Devices from one manufacturer often transmit and receive information according to protocols which other manu-

facturers do not follow.

However, recently developed data-link standards may eventually allow all kinds of computers, even those outside the

Sorting out protocols

Network data communication is often referred to as being organized in protocol *levels*. Only the first three protocol levels apply to local networks usually found in factories. Network definitions are separated into levels to allow changes in communication hardware or software without having to redefine whole new communication schemes. For example, software once performed many data-link control tasks (Level 2), but specialized protocol communication chips now do most Level 2 tasks. Level definitions permit

changing control of Level 2 tasks from software to hardware without altering software or hardware for tasks on other levels.

Some protocols do not fit well into a layered structure. For example, character-oriented DLC protocols contain many higher-level functions, such as code and character specifications, because they depend on the transmission line configuration. Hence, changing from a character-controlled format to a bit-oriented protocol requires redesigning Level 2 hardware and most of the system software.

Protocol hierarchy

Level	Function	Examples
1	Describes the physical link (usually wires) between devices in the network.	Typical electrical standards are RS-232C, RS-422, RS-423. Details electrical levels used, number of signal wires, other similar factors. Functional and mechanical standards detail connector types, wire size, and similar factors.
2	Describes data line control (DLC) format.	Details how messages are made up, information codes used, message contents and length, control characters used, error checking procedures. Most common bit-oriented DLCs are HDLC and SDLC. Most common byte-oriented DLC is IBM Bismarck.
3	Describes network control.	Determines the order in which network devices can send messages, device priority for sending messages, how devices are connected within the network. Most common standard for switched networks is CCITT* X.25, which also covers protocol Levels 1 and 2.
4	Describes system and user control within one computer.	No standards exist. Generally governed by manufacturer network software architecture packages. One example is IBM SNA.
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*International Consultative Committee for Telegraphy and Telephony