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Data Bulletin

Web-Enabling Variable Frequency Drives
Class 8806

THE EVOLUTION OF DRIVE NETWORKING

Over the past several years, drive networking has advanced from one-way communication, using dry contacts and proportional signals, to two-way communication, helping users troubleshoot problems or tune the drive. This evolution has come a long way in a short time and can be broken down into three phases briefly described below. The next and most exciting phase in this evolution involves web-enabled Ethernet, which will lead to fundamental changes in drive communications.

Phase One
Network Connection to an Intelligent Device

The intelligent device (such as a PLC or building automation system) communicates with the control network, then with the drive via traditional dry contacts and proportional signals (4–20 mA, 0–5 Vdc, 0–10 Vdc). In basic systems, the drive receives commands, as if it were a mechanical actuator—like the damper controls and valves that the drive replaced. In more sophisticated systems, the drive feeds back information, such as dry contact closures for drive status (for example, power, run, or fault) or proportional signals (such as motor speed, motor amperage, or motor power).

Phase Two
Network Connection to the Drive: One-Way Communication

The drive is directly connected to a MODBUS®, UNI-TELWAY, N2, or other serial network, and is used for control only. The network simply instructs the drive to turn the motor on or off, and at what speed to operate it.

Phase Three
Network Connection to the Drive: Two-Way Communication

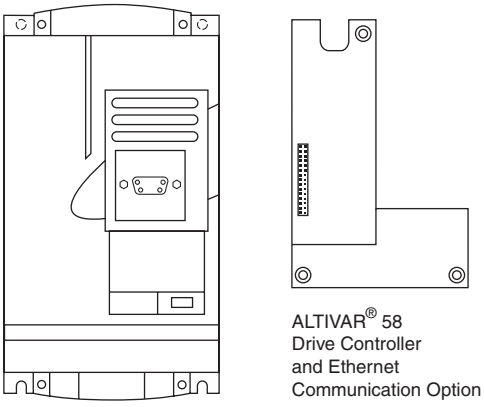
The drive performs in a control capacity as described above. However, the link is also used to monitor the status of the drive or to read data, such as fault logs and variable states, to help troubleshoot the drive in the event of a fault. Sometimes this link is used to reprogram or tune the drive.

These phases all require special software, network knowledge, and wiring of the control network. For example, the wiring, junctions, and terminations of a MODBUS Plus network are quite different from those of a DEVICENET® network. Supporting technicians require training in all of these areas.

Moreover, any computer displaying this information requires special configuration of the software and network connection. Users of the software require specific training. And any graphical display of the data requires additional technical software.

THE NEXT PHASE
TRANSPARENT FACTORY CONNECTION

The next step in the evolution of networked drives is to ensure that the details of accessing information are transparent to the user—a goal met by web-enabled Ethernet.



ALTIVAR® 58
Drive Controller
and Ethernet
Communication Option

The simplicity of the Ethernet network is the first benefit. Each standard industrial control network has wiring and addressing peculiarities that require training, but the implementation of Ethernet is widely understood. (Many debates have taken place on the relative levels of determinism between older control networks and an Ethernet network; however, it is understood today that the maximum time for data transfer is a function of how an Ethernet network is switched—not of the network itself.)

The second—and even more significant—advantage is that the system is web-enabled. By itself, pure data is not meaningful when simply sitting in the data registers of a drive or PLC. But if that data can be put into the proper context, a synergy results. Data evolves into information, and information evolves into knowledge. The communications link is transformed from a simple control network to a true human-machine interface (HMI), available to anyone.

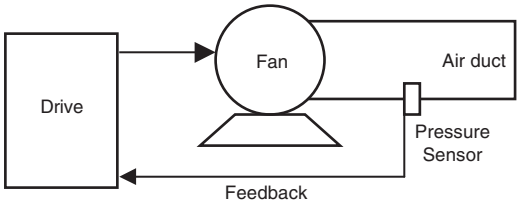


Figure 1: PI Loop Example

In a typical example of a simple loop, a drive controls a fan feeding into ductwork in an HVAC system. A pressure sensor exists in the duct, and the drive is configured to maintain a setpoint pressure using PI control.

A number of HMI packages and drive control programs use software to present information in a meaningful way and simplify drive programming, compared to using a keypad. However, the software runs on dedicated computers, which are configured and wired for the specific industrial control network involved, thereby limiting the software's usability.

With a web-enabled Ethernet connection, a drive can provide HMI functions as well as superior programming capability without any special software running on an individual computer. The software resides on the communications card in the drive, meaning that the user can access it with nothing more than a browser such as Microsoft® Internet Explorer or Netscape Navigator®. As an added advantage, this connection works anywhere that users can access their own intranet. As long as they are inside their corporate firewall and have the correct addresses and passwords, they can monitor and control a drive in San Francisco from a computer in Paris.

Other advantages of web-enabled Ethernet for drives include simplified wiring and software. And as the concept evolves, more benefits are emerging. To illustrate, consider tuning a PI loop like the one shown in Figure 1. For many people working with drives, tuning a PI or PID loop is more of an art than a science. This kind of tuning—when based only on data—is very challenging and requires a high level of expertise.

Using web-enabled technology, a screen can be set up in the drive to provide a real time plot of both the setpoint and the feedback signal for a drive control scheme. The screen also provides setup tools for various PI control variables. Figure 2 shows an example of such a screen from an actual system using simple JAVABEANS™ programming for the display.

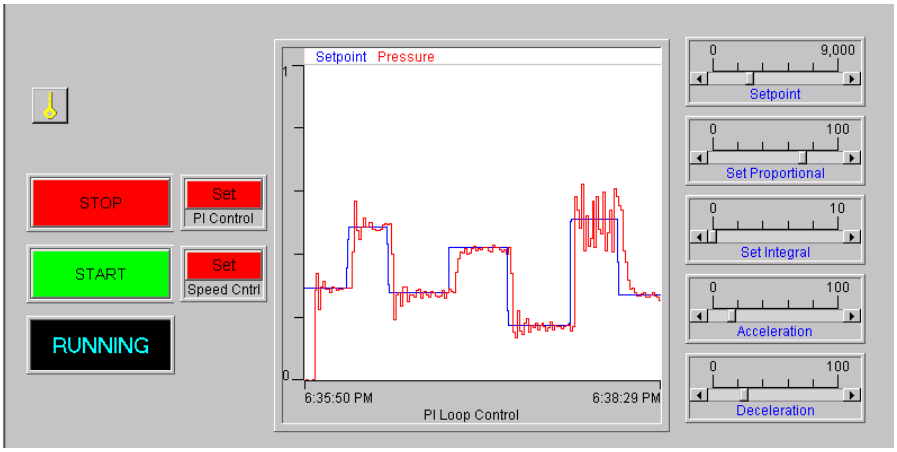


Figure 2: Example of a JAVABEANS Screen

With this type of a display, the user instantly sees the effect that variable changes are having on the overshoot and dampening of the system. The time required to tune the system is significantly reduced, and the user has a more intuitive feel for what is happening in the system. All of this is done with nothing more than a web browser. Special software is not required on the computer involved.

Web-enabled Ethernet represents a significant advance in the control and operation of variable speed drives. It will lead to fundamental changes in drive communications.

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