

The Thinker

Variable frequency drives and soft starters offer intelligence as a point of differentiation

Technology is a big umbrella. It can offer protection from a variety of risks. And a lot of components fall under it. It's often hard to tell the difference in offerings beneath the expanse of that large technology umbrella.

From sensing devices and soft starters to I/O modules and variable frequency drives (VFDs), automation has become so ubiquitous that it can sometimes feel like one big amalgamation of commoditized elements.

Even process manufacturing plants are asking skid builders to standardize with the same interface so they can pull out one skid and insert a new one in its place. The opportunities to differentiate are diminishing.

This has become especially true with VFDs and soft starters—products whose primary purpose is to spin the motor. But, besides the core function, these products now come with intelligence built into them to do even more than just control the speed. It's an opportunity to get more out of VFDs and soft starters, which now can have PLC capability available. Some are equipped with a software-based PLC feature, which can be edited with ladder logic. A VFD or even a soft starter can be used to take over and run a basic machine with a few I/O.

Industry has come to embrace ladder logic. The early PLCs were wrapped around the idea that code could be created on a screen that allows the PLC to provide functionality. And ladder programming is the offshoot of what was formerly done in hard copy, but each vendor has its own slant on how ladder is programmed.

Lower installation costs, better decisions

If you're a machine builder and you need a few I/O functions but, in the background, you're going to run a master control program that determines which subroutine does which function, built-in intelligence saves you from buying an additional separate controller. Everything is getting smaller and less labor-intensive. From the assembly and manufacturing perspective, this creates efficiency and space savings.

Without using precious panel space and hands-on interconnect wiring, machine builders are able to accomplish more. In many instances, these VFDs and soft starters with built-in PLC capabilities can be put on the network to talk with a master controller in a higher-level system, so the device can manage some small corner of the process and report back to the central controller or alert other sections along the process.

The VFD has diagnostics stored in the memory, so, for example, if it runs at high current, it will already know how it needs to respond. The same information can be shared in the PLC portion because it has access to the memory points. It can be programmed to send an alert back to the master controller to indicate it's having some problems that might cause a shutdown, for example. For some processes, if you shut down without first clearing the material out, it can have disastrous results. With built-in intelligence more decisions can be made that are based on particular events.

Small is the new big

With the continued evolution of variable frequency drives (VFDs) and solid-state reduced voltage starters (RVSSs), more power is being packed into even the smallest modules, not just in the power components, but in the unit control processors, as well. This translates into motor speed controllers with more smarts that take up less space.

Even small fractional-horsepower-rated VFDs and RVSSs are including some level of PLC ladder logic programming capabilities. Networking that uses industrial protocols is now considered a mainstream feature, and it doesn't stop there. Interfaces including USB, Bluetooth and infrared wireless for no-touch access to the parameters and programming of the devices are becoming more prevalent. With the built-in controller, VFDs save precious space. Plus, many can accept overloads for significant stretches, eliminating the need to oversize the VFD.

If I only had a brain

Machine builders are looking to get more than just start and stop out of their motor controls. They want functionality from their VFDs and soft starters. Drives are becoming smaller, but with bigger options. From built-in HMIs and detachable fans to plug-in communication modules and I/O options, drive features have expanded, enabled primarily by the increased capabilities of the controller.

Energy saving algorithms: Higher-efficiency permanent-magnet motors will be deployed more frequently. These require drives with new control algorithms, but some drives already incorporate algorithms that allow for control of permanent-magnet motors. Several vendors can now manipulate the magnetic field of an induction motor when it's not being run at full power. By changing the strength of the magnetic flux of the induction motor, the baseline energy used by the motor can be reduced. The algorithms monitor how loaded the motor is and then change the baseline flux, eliminating excess magnetism. In effect, this rightsizes the magnetic flux, which can create an impressive cumulative effect with multiple motors. With variable torque loads—when the motor is not running flat out—there's a strong energy savings from the load curve of that particular device. This already is an established, comfortable expectation. On top of that, motor operators can realize up to several percent additional savings on that one motor. With hundreds of motors in a plant, the cumulative effect can be enormous.

Local interlocking and permissives: In control systems where certain conditions, or permissives, must be met before a piece of equipment is allowed to start, the controller scans the switches before starting. Each interlock contact is wired in such a way that the circuit will open if an unsafe condition is detected by one of the switches. If all of the conditions are met, then an equipment start can be initiated. Because of the localized PLC logic for the permissives, rather than having the permissives going back to the main processor, this can be managed as a response on the local level.

PID functionality: For drive control, a PID or control loop is the way to go. Many drives have built-in PI or PID loop capability, and it can be programmed for the application. Some interfaces are easier to use than others, but the PID or control loop is programmable right in the drive control. Often these drives are used to manage a level control in a reservoir or a pressure control or a flow control in an air system, or even the atmospheric pressure in a building such as an inflated dome. It's becoming more common to have process variable control. Because it's in the drive, there's no need to add an extra PI controller.

Adjustable sleep/wake functions, power measurement and information logging: VFDs also have programmable sleep and wake functions, which allow the drive to be started and stopped with a feedback signal. Additional programmable capabilities could include local currencies and energy-savings displays. Sometimes the process controller says to slow down. Rather than having the drive idling, it can actually go to sleep until the PI regulator demands more. Then the drive wakes up and resumes the process.

Think locally, act locally

When machine builders needed to create localized functionalities, they had to add another logic processor into the system, program it and hook it up. But that's not the case any more. The logical processing is built into the drive or soft starter, which also expands the capabilities. Turning the motor is old-hat. Anybody can spin a motor. For many drives, that's all they do and all they're required to do.

Programming is easier with a built-in keypad or remote USB-cable-connected keypad. The controller is capable of monitoring multiple parameters, as well as operation status, faults and alarms. Depending on the application requirements, plug-in communication, I/O modules and Flash memory modules are available with the capacity for thousands of operations. The memory modules have the ability to save drive parameters and PLC code while protecting intellectual property by means of a password.

They still need central monitoring stations, but the local control can possibly eliminate the need for remote intervention. It recognizes the problem and can offer a local resolution, even if it's a short-term solution. The problem might be one the drive can resolve temporarily, but it still needs a permanent fix. For example, what is the appropriate degree of reaction based on a particular problem? That logic can be built into the drive or the soft starter itself to designate the level of importance or severity.

Soft starters are mainly involved in the startup of a particular motor where you might want to limit the current draw. Some utilities might penalize you if you draw too much current. If all you need to do is run the motor at full speed, but you don't want to start it with a heavy surge, then the soft starter fills the bill perfectly. Ramping up to speed on conveyors is definitely a sweet spot for soft starters. On the other hand, on an inclined conveyor system there may be advantages to ramping the speed down instead of a sudden

stop. There's usually some type of one-way brake that needs to be engaged and a gradual stop will enhance that operation.

Another thing soft starters are capable of is helping to avoid a water-hammer effect. If you're pumping water in a system and it's time to shut down, many soft starters can go back into the soft start or "electronic" mode and reduce voltage gradually to allow the check valve to close gently, so the water doesn't hit it like a hammer.



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