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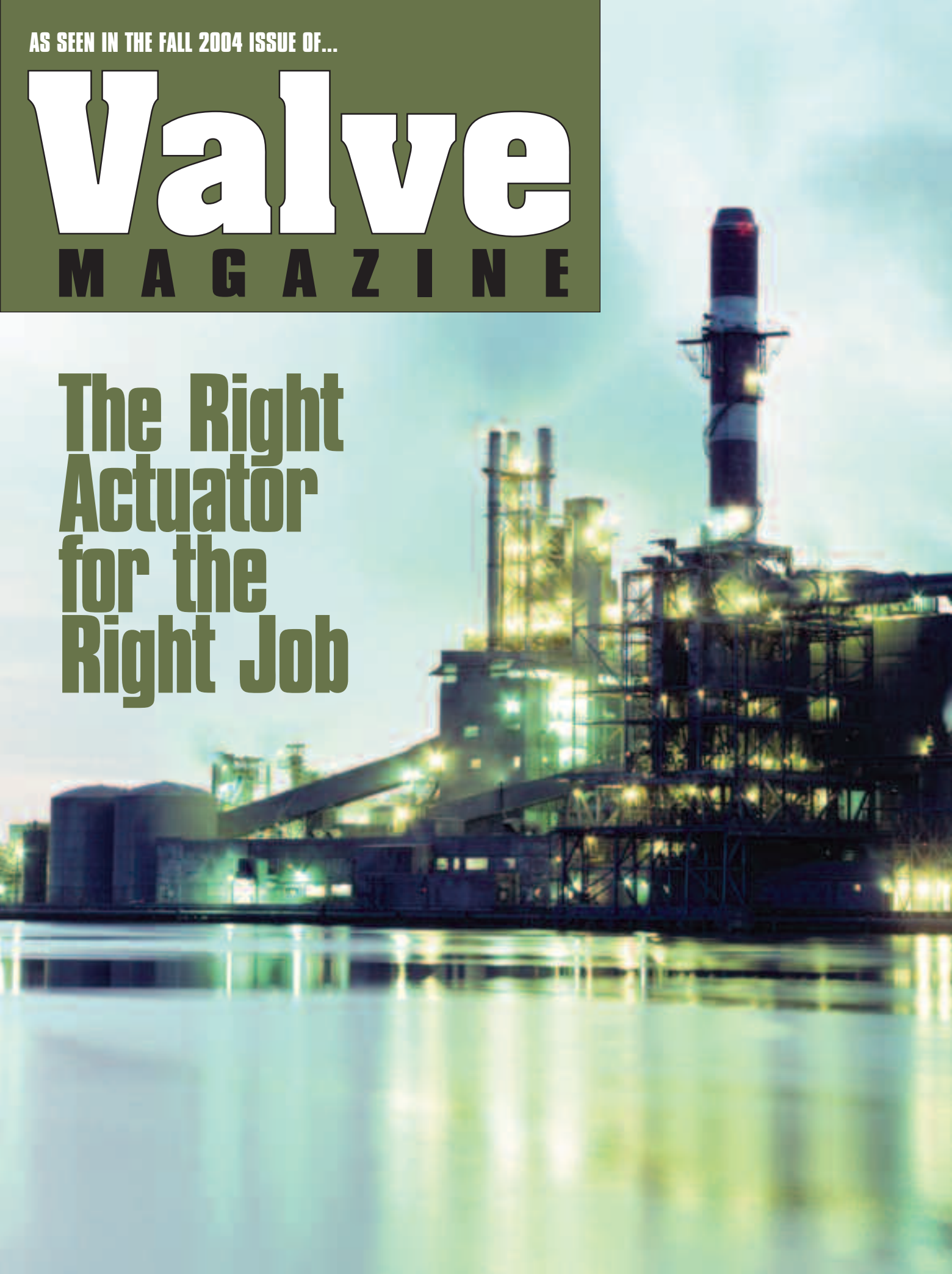
# Valve MAGAZINE

## The Right Actuator for the Right Job



# THE ACTUATOR CHOICE:

# TRADITIONAL OR HIGH TECH?

## DO YOU REALLY NEED A HIGH-TECH, NON-INTRUSIVE ELECTRIC ACTUATOR? THE RIGHT ACTUATOR SYSTEM FOR YOUR APPLICATION MAY NOT NECESSARILY BE THE MOST SOPHISTICATED.

**BY RICHARD D. OAKS**

Over the past several years, electric valve actuators have become high-tech wonders. Thanks in large part to the availability of cost-effective microprocessors, they offer a wide range of features. Though these highly sophisticated, costly actuator systems may be preferable for some critical applications, many facilities can function quite well with simpler equipment. Before making a decision on whether to purchase high-tech actuators or deciding what level of technological sophistication is needed, plant owners and operators should take a step back and review the development of valve actuator technology and where their applications may fit into the picture.

### In the Beginning

Electric actuators were first introduced in the 1930s, offering plant personnel a way to operate valves relatively easily, efficiently, and economically. These devices were immediately recognized as extremely useful and were quickly adopted worldwide for a wide variety of flow control applications. While these actuators were technologically advanced for their time, they actually began as motorized gearboxes with position limit switches and torque switches that determined when the end of valve travel was reached or when a pre-determined level of torque required to operate the valve was exceeded. Motor switch gears and controls such as reversing starters and pushbuttons were located at large motor control centers or control panels. This was a big step forward compared to operating a valve manually (Figure 1).

Eventually, electric actuators were offered with "hard-wired" integral motor controls. The integral motor control package usually included reversing starters to control the motor, a control power transformer, and pushbuttons or switches for local control. Providing integral controls not only saved the owner time and materials during installation, it also made startup and commissioning faster and more efficient for the contractor.

Integral controls were then supplemented with positioners and position feedback transmitters. The positioners were capable of accepting analog control signals, usually 4–20 milliamps, to control the valve at any point between the fully open and fully closed ends of travel. The position feedback transmitters provided a continuous indication of the current valve position. These devices gave plant operators additional information that enhanced the ability to control processes more efficiently.

The concept of integral motor controls also provided users the ability to specify actuators that functioned by merely connecting the motor power supply and the control circuit wiring required for remote control and monitoring.

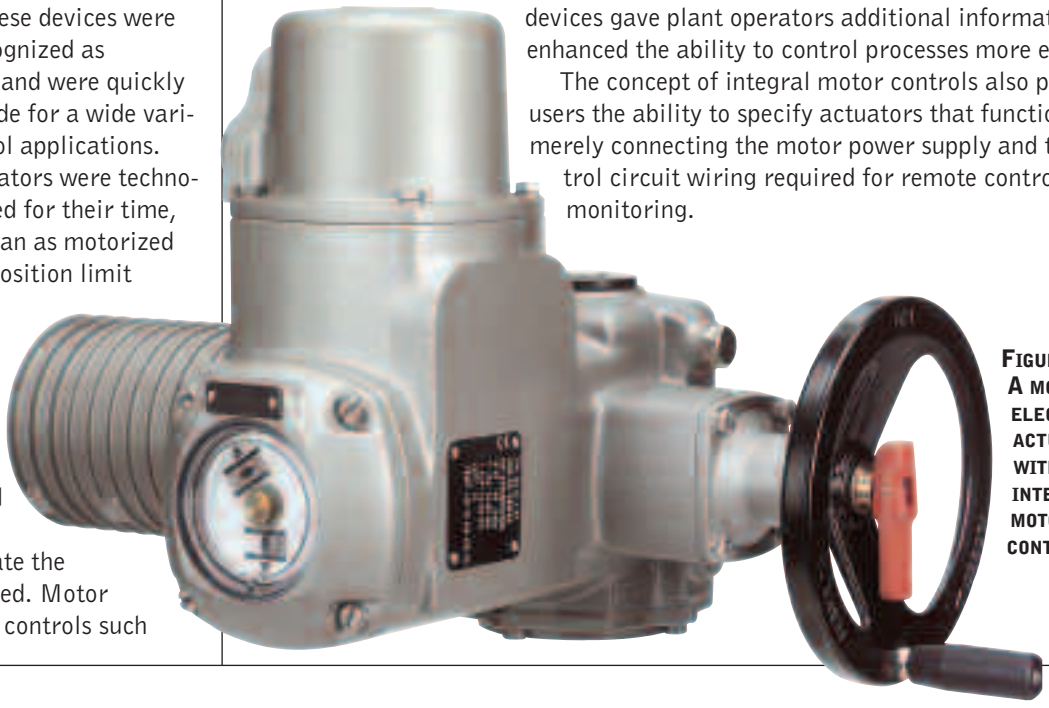


**FIGURE 1. A MODERN ELECTRIC ACTUATOR WITHOUT INTEGRAL MOTOR CONTROLS**

Despite this "advanced" control assembly, one typical start-up issue was common for many installations. If an actuator was mis-phased during initial commissioning, the valve would travel in the direction opposite to what was desired when either the open or closed direction control circuit was energized. If power was applied before the limit switches were set and the valve was found to be moving in the opposite direction, the start-up technician had to cut power prior to reaching the fully open or fully closed valve position. Since the motors typically used with actuators could produce a high stall torque as the motor speed approached zero (locked rotor condition), damage to the new valve was likely. Though torque switches were designed to prevent damage when a valve's torque requirement suddenly exceeded the actuator's maximum capability, these switches only functioned after correct motor phasing was established.

The next step in electric actuator development was introduction of phase discriminators in the integral control assembly. This component would not allow the actuator to function until the power supply leads were properly connected. Today, many actuators have upgraded "phase correction" devices that ensure the actuator moves the valve in the correct direction of travel regardless of how the incoming power leads are terminated.

Also introduced were thermal overload contacts mounted directly to the stator inside the motor housing. Today, most actuator manufacturers offer this feature.

## Enter the Bus

As digital or field bus communications came into play in the 1990s, it became possible to control multiple actuators with a common bus. Digital communications control results in significantly lower installation costs and provides plant operators more information from the automated valve. The bus allows information on valve position, operational data, and diagnostic data to be easily transmitted to the plant control system.

This brief review of electric actuator history shows that even traditional electromechanical actuator designs have reached a respectable level of sophistication as far as operating controls and protection devices. Traditional and conventional designs provide user-friendly set-up capabilities, adequate overload protection and, if desired, diagnostic indicators that can signal events such as a loss of phase, tripped torque switch, or tripped thermal overload contact. The conventional operator design is still an industry workhorse and is the correct choice and best value for many applications. In fact, most electric actuators today are furnished with integral motor controls and are controlled with either conventional I/O or digital communications (Figure 2).

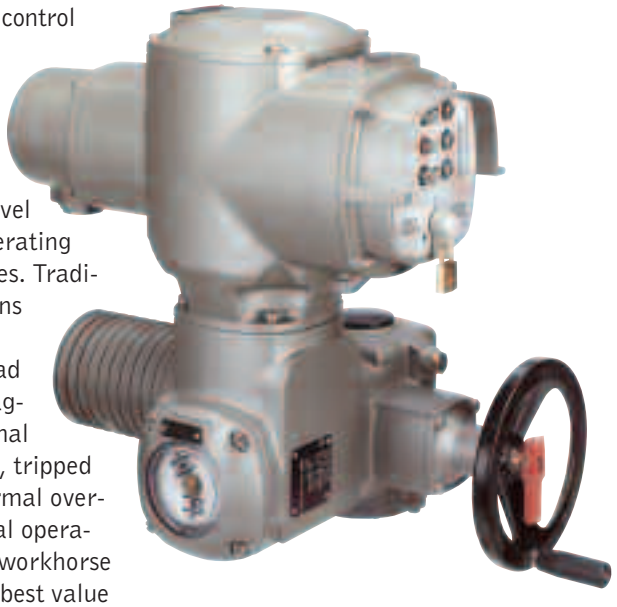


**Figure 2. An electric actuator with integral motor controls**

Until the mid-1990s, most actuator parameters were set up by gaining access to the inside of the actuator. This meant removing a cover, making various adjustments, then reattaching the cover. The parameters include setting position limit switches and torque switches, and adjusting position feedback devices or positioner boards.

Setting an actuator in this conventional manner requires a screwdriver or other common tools, which mechanics, electricians, and technicians involved with commissioning generally have readily available.

## Still More Technology

As the 1990s progressed, electric actuators were designed with more sophisticated technology. Through microprocessors, encoders can sense position and torque instead of using conventional switches, which allow actuator parameters to be set without gaining access to the interior. In certain applications, setting parameters in this "non-intrusive" manner minimizes safety, environmental, and location issues. For example, in locations where hazardous gas or dust is present, the non-intrusive capability minimizes the potential for spark-producing components of the actuator to come into contact with the gas or dust. By eliminating the need to open the actuator, the chance is minimized that a removed cover will be forgotten, which could result in contaminants entering the actuator over an extended period of time. In addition, electronic non-intrusive actuators offer features that can aid operators, such as digital readouts of valve positions, digital display of torque output, configurable output relays, configurable indicating lights, a variety of fault displays, optimal control tuning by analog signal, and data logging (Figure 3).

The argument is frequently made that opening an actuator to make adjustments can lead to moisture ingress, resulting in damage to internal actuator components. For this reason, traditional actuators have included switch compartment space heaters that are continuously energized, producing up to 20 watts of heat. These heaters prevent damage to the electrical controls caused by condensation.

Setting the parameters of electronic actuators non-intrusively requires either a separate tool (laptop, PDA,

etc.) or manipulation of pushbuttons and/or switches that respond to menu prompts in the actuator's LCD display. While manufacturers have successfully made the commissioning procedure for non-intrusive actuators as easy as possible, these procedures still must be learned by plant personnel. These new procedures mean the person carrying out the commissioning process needs some technological aptitude or at least a willingness or capability to learn. New procedures also mean plant operating and maintenance personnel must understand these procedures in the event adjustments or maintenance is required in the future. Unfortunately, not everyone has the aptitude or skilled staff to learn the new procedures. We must remember that many very competent plant technicians keep actuators operating smoothly with only a volt/ohm meter and a screwdriver.

A good analogy when considering whether to use electronic non-intrusive actuators is to compare it to the decision weighing whether to buy a navigation system for a car. A navigation system can be very useful if you travel to unfamiliar locations and have the desire to learn how to use the new system. It's also an interesting and fun-to-use device. However, if you don't have a need for such a sophisticated system or you don't want to bother to learn how to use it—you might decide you really don't need it. You also must consider whether you'll remember how to use the device in the far future. Will you have to refer to the instruction manual at a critical time in driving? Will you be able to even locate the instruction manual?

## Examples of Actuator Selections

These examples should help in the decision about how sophisticated a system you need.

A wastewater treatment plant in the Midwest was recently refurbished with 86 new electric actuators. The customer quickly recognized the value of using the digital control system to greatly reduce cabling costs and to provide more valuable actuator status data to the control room. In this case, the actuators were conventional instead of the newer non-intrusive design. Although the customer was pleased with cost savings and better data, this customer also recognized that the conventional design was a better value because most of the additional features that more sophisticated electronic actuators have would not be used in this particular installation.

**FIGURE 3. AN ELECTRIC ACTUATOR THAT CAN BE SET NON-INTRUSIVELY**

In another situation, the owner of a power project in the Midwest took a different approach. After carefully reviewing information on electronic actuators as well as digital networks, the owner recognized the advantages offered by using actuators in digital networks and decided to control by means of digital communications. In this case, the client felt that his technicians would in fact benefit from the data logging and additional information available from the newer, non-intrusive electronic actuators.

While the research and eventual decision about what product features a particular plant will need is up to the plant owner or engineer, actuator manufacturers can assist them in making the optimal choice for a given application. Experienced specialists understand client requirements and constraints and can explain the benefits of the various options available. It's wise, however, to obtain this assistance early in the planning stages.

Even before deciding the level of electric actuator technology needed, it is worthwhile to ask some basic questions, such as:

- What are the needs of the application?
- What are the capabilities of the staff?
- Do we really need the more sophisticated features to get the job done right?

Yes, the actuator industry has come a long way since its earliest days, and actuator manufacturers are constantly updating their designs to include the latest features. But most manufacturers offer a wide range of both conventional and non-intrusive actuators. Many plant owners and operators may have real need for the more sophisticated features offered by electronic non-intrusive actuators. However, others just want to open and close a few valves, and for that, a conventional actuator will suffice. **VM**

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