A USER'S GUIDE

RETROFITTING VALVE ACTUATORS

How to upgrade existing manually operated and old-technology valves cost-effectively and conveniently in your facility.

rotork

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RETROFITTING VALVE ACTUATORS

By: Chris Warnett
Rotork Controls, Inc.
19 Jet View Drive
Rochester, NY 14624
716-328-1550
FAX: 716-328-5848
E-mail: info@rotork.com
Website: http://www.rotork.com

INTRODUCTION

Automating valve operation throughout a facility or in key strategic areas within the plant can offer substantial cost savings and improvements in efficiency and safety.

Today, the new generation of valve actuators and two-wire communication systems provide an easy way for virtually any large or small plant to cost effectively retrofit their manually operated valves with automated systems. Most important, the retrofit often can be accomplished quickly without the need for major plant reconstruction or complicated reengineering.

Technology has made advances in almost every field over the last few years, but the advances in microprocessors and computer technology have been far greater than many other technologies. For that reason, we see many processes in the municipal water treatment, power generation, and oil and gas industries advancing, but often not as rapidly as the technology advancements in the control and supervisory systems that run these plants. The advent of miniaturization and the effects of cost-reduction have made the application of control systems more powerful and less expensive.

Throughout the industrialized world, there are a vast number of installations that could benefit from increased productivity by the application of modern control technology.

By applying new controls to old plants, many benefits can be accrued. This is the essence of retrofit.

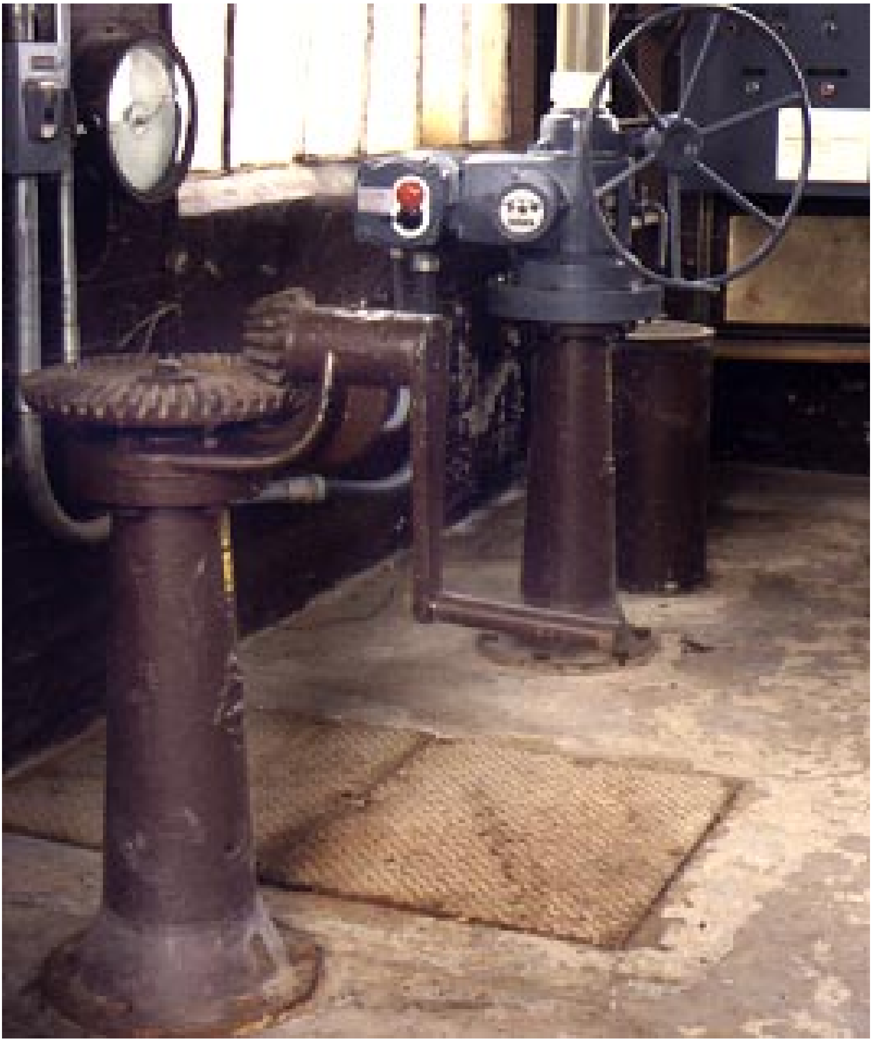
The purpose of this booklet is to explore the application of modern valve actuator and control technology to existing installations and to offer insights on how it might benefit your situation.

BENEFITS OF RETROFIT

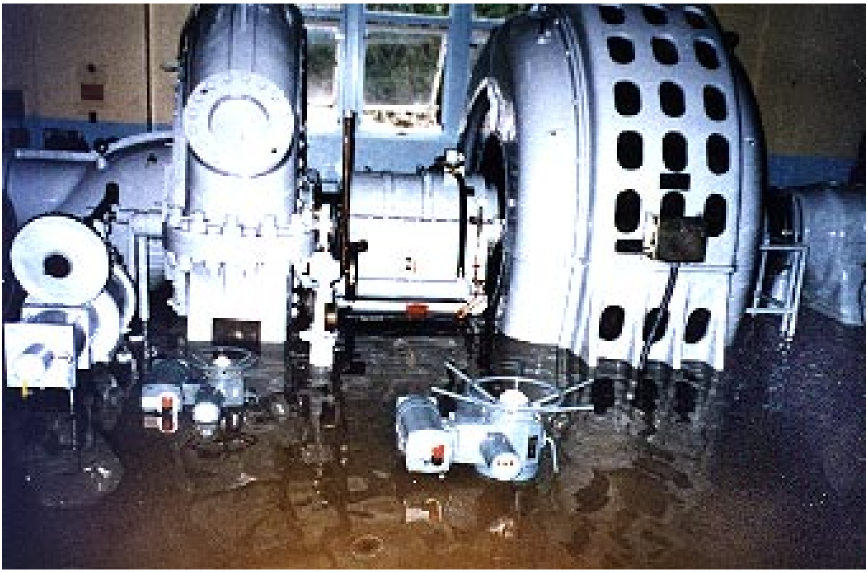
The overall benefit of performing a comprehensive retrofit on a plant accrues from the ability to operate the plant more efficiently. Specifically, when we retrofit, we are replacing manually operated valves or old-technology valve operators with modern valve control equipment.

One of the major advances of valve actuator technology that helps make retrofitting a practical reality is that the presence of moisture, dirt, and extremes of temperature do not affect the operation of today's generation of automated valves. For example, the IQ line of electric valve actuators was designed with proven “double-sealed” capability, which prevents the ingress of moisture or dirt. It also provides non-intrusive operation such that the IQ's electric covers do not have to be removed during configuration, commissioning, and resetting. Furthermore, there are smart capabilities built into the actuator that provide for superior levels of around-the-clock monitoring and control.

Simply stated, the old-school of thought that valves in hostile or challenging environments must be manually operated is outdated and can reduce a plant's efficiency and productivity.



It's possible to retrofit even very old valves. The old valve in the foreground took hours to manually open and close. The retrofitted valve in the background is on a control system and takes but a few minutes.



When a disasterous flood inundated the Tacoma Public Utilities' La Grande hydro plant on the Nisqually River in Washington, the Rotork actuators pictured above "were as good as new," according to Bill Jones project manager for the Nisqually Hydro Project.

Specifically, valves that are large and take a long time or a lot of force to operate manually can now be operated rapidly and reliably utilizing the retrofitted actuator. The speed of operation of any particular valve can now be selected without the constraint of space or the limitations associated with how many workers can stand around and operate a handwheel.

Quite often, valves are located high up in buildings or deep in sumps or pits where it is difficult and impractical for personnel to reach them. Sometimes they are located in hostile areas where there are noxious fumes or liquids, making it physically distressing to operate the valve manually. The manual operation of valves is a common cause of worker injury, particularly where there are old valves that require excessive amounts of force to operate.

When valves are operated manually, plant operations are dependent on the human operator to ensure that the valve is in the correct position. This information has to be transmitted back to the control room, which, in the past, was done by word of mouth – sometimes an unreliable method. By retrofitting a valve

Many valves are located in hostile, hard-to-reach environments. By automating them, several benefits result, including less risk of worker injury, increased productivity, and improved efficiency. Here, a P Range pneumatic actuator is used to operate a large butterfly valve in a tunnel.

actuator, the integral position indicating mechanisms of the actuator enable both local and remote indication of the position of the valve. In this way, confirmation of valve closure can be transmitted instantaneously to the control room.

Once a plant or a section of a plant has been retrofitted with valve actuators, then centralized control can be affected, increasing the throughput of the plant and reducing the workhours spent manually operating valves. Retrofitted plants can run for an increased number of hours per day, further increasing return on investment and efficiency.

There is another substantial benefit to retrofitting that addresses the world's increased concern about fugitive emissions, contamination from spills, and other environmental issues. That is, automated equipment can open or close valves under emergency situations, thereby avoiding spills and other accidents. Logic controllers can be used to analyze the status of flow control elements and make the correct selection of which valve to actuate in order to prevent accidents. The advanced monitoring capability of two-wire communication systems, such as the Pakscan IIE and IIS systems, ensures that the motor operated valves are constantly checked for availability to react to emergency circumstances.

Most important, retrofitting is now affordable and convenient. No longer is it necessary for old plants to engage in a major physical renovation or reengineering of their existing processes to upgrade to automated valve operation.

With the coupling of modern electric and fluid power actuators to digital control systems, the cost of retrofitting is now affordable to large and small facilities alike.

MOST FACILITIES CAN BENEFIT FROM RETROFIT

Almost every type of plant can accrue some benefit from a retrofit program. Below are some typical examples. (See Rotork's website at http://www.rotork.com for up-to-date case histories, user comments, and onsite-photos.)

Refinery Tank Farms

The inlet and outlet valves on a tank are located adjacent to the tanks themselves. Tanks are generally spread over a large acreage, therefore operating these valves requires a considerable amount of time for an operator to travel to each valve and then manually open or close them. Once the appropriate valves have been set to the required position, then pumps can be started to move

Retrofitting valves on tank farms provides many benefits, including the ability to provide for the quick shut-down and start-up of the flow of oil from one area to another. Valve automation also provides a much greater degree of environmental protection than manually operated valves.

the products from one area to another.

These installations are ideal for retrofit because of the distances involved, and also the catastrophic consequences of co-mingling or spillage. By using electric valve actuators linked by Pakscan communication to a central control room, fingertip control of each valve can be achieved with positive verification of the position of each valve.

Water Treatment Plants

There are many water treatment plants around the world that have been in constant operation for many years. Some utilize automatic valves while others use manual valves. The older automatic valves are often powered by water hydraulics or compressed air. Because of the age of this equipment, a considerable amount of maintenance is required due to wear and the corrosive effects of the moisture and/or chlorine in the atmosphere.

The new generation of fluid power and electric operators can reduce maintenance requirements and streamline the backwash operations by

The Pakscan IIS two-wire communication system offers a cost-effective way for water and wastewater treatment plants to obtain the benefits of valve automation. An AQ actuator is pictured in the background, and a programmable Pakscan IIS master station is at top right.

preprogramming them in a Pakscan IIS master station or the available host computer.

Wastewater Treatment Plants

As environmental concerns increase around the world, the emphasis on clean water sets more demands on the wastewater facilities. Many wastewater facilities can benefit from automation of sections of their plants, both large and small. Where operations have to continue around the clock, the demands on personnel can be reduced by having processes automated, substantially reducing or eliminating the need for personnel to be present.

Power Plants

Power plants are an example of an extremely high capital cost plant. But, even where the main steam circuits and generating equipment still function well, important benefits can result from strategic retrofitting in the plant. That is, modern control equipment can significantly reduce manning levels and increase plant efficiency. Also, in old plants, space for additional motor controls may not be available. Here the integrated motor starters of the IQ actuator can give great benefits for retrofitting feedwater valves, boiler trim valves, and many other applications on a power plant without the need for additional motor controls at the motor control center. Furthermore, load fluctuations can be more easily accommodated by using digital two-wire communication technology to piggyback automated valve controls into existing DCS systems.

FIRST STEPS IN THE RETROFIT DECISION PROCESS

Almost every facility can benefit from automation. The scale of a retrofit can vary enormously with the type and size of plant.

Rotork valve actuators have been used to automate the level control on a reservoir utilizing just two valves; they have also been used to automate hundreds of valves on large tank farm automation upgrades. However in both cases, the retrofit elements can be broken down into a few discrete steps.

First there is the selection of the particular type of valve actuator. This selection is dependent on many external factors, including the available power source, the required mode of operation, the environment, and so forth.

Then the valve actuator has to be controlled by some means. This could range from manual push-button controls at the actuator to sophisticated digital communications linked to a host computer some distance away.

These two elements, the actuator and its control method, dictate how to proceed with the retrofit. Regardless of whether it is one valve or a thousand valves, the decisions made and the information required are the same.

Plant owners or their consulting engineers usually have made a decision on the type of power source to be applied to the automated valve, and the type of control required, such as on/off, modulating, or fail-safe. For users who have not made that preselection, the available power sources for valve actuators usually include three-phase or single-phase electricity, shop air supply (usually around 80 psi), line gas for gas pipeline applications, or water pressure in water treatment plants. If any of those power supplies are readily available, then this may dictate the selection of actuator type.

To remotely control valve actuators, there needs to be some source of control power that emanates either from the host controller, the actuator itself, or a backup or auxiliary power supply, such as solar energy. Once the power supply has been determined and the control philosophy has been defined, then actuator type selection can be made.

By definition, retrofitting means the installation of a valve actuator onto an existing valve.

Valve selection, therefore, is not a criterion we need to be concerned about; however, we are most concerned about the type of valve that needs to be automated. From an actuator manufacturer's point of view, valves can be segregated into two types: (1) multi-turn and (2) quarter-turn.

Multi-turn valves include gate valves, globe valves, and sluice gates. Quarter-turn valves include ball valves, plug valves, and butterfly valves as well as louver and butterfly dampers.

For multi-turn valves, the available actuator selection is IQ Range, A Range, PAW, PL, and HPL.

For quarter-turn valves, available actuators are IQ Range plus quarter-turn gearbox, A Range plus quarter-turn gearbox, AQ Range, Q Range, P Range, H Range, R Range, and HPG Range.

Having selected the type of actuator, the next step is to size the correct actuator to the corresponding valve. Different valves require different torque

Above is an example of a multi-turn valve and IQ actuator.

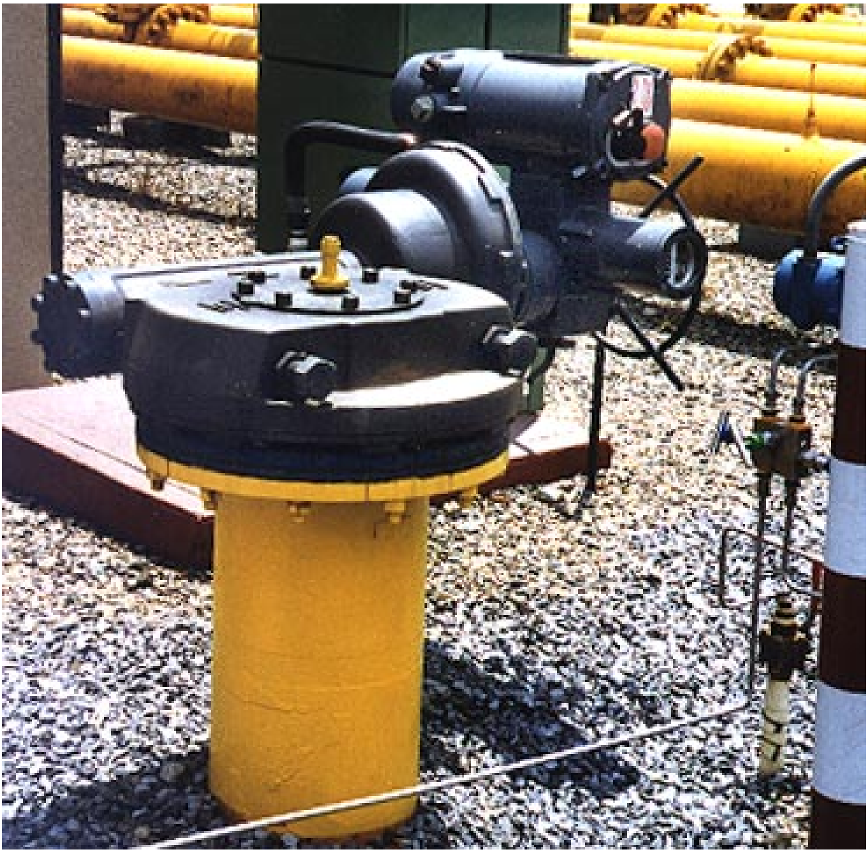
inputs because of varying size, pressure class, and mechanism. There is a wealth of detailed engineering information on how to size valves (contact Rotork for more details).

The category of valve determines the sizing procedure. For quarter-turn valves, the torque information has to be gathered from the valvemaker or from a reference database at the actuator manufacturer. The torque for multi-turn valves, however, can often be calculated using tried and proven calculation methods available at the actuator manufacturer.

Because the power delivered by an actuator is a function of both torque and speed, sizing cannot be completed until the required speed of operation is known. In most instances, gate valves are required to operate at the rate of 12 inches per minute. For quarter-turn valves, a similar rule of thumb suggests valve operation at a rate of 60 seconds for every 12 inches of valve diameter. Hence, a 24-inch gate valve would operate in two minutes and an 18-inch ball valve in 90 seconds.

Differing applications may, of course, require higher or lower speeds, and this will affect the size of the actuator.

Every plant has different parameters; however, to do a successful retrofit, the two fundamental stages of powering the valve and then controlling the valve can be broken down to give you a road map



The photograph above shows an example of an A Range actuator plus quarter-turn gearbox.

on how to proceed with your retrofit.

POWERING THE VALVE

1. Choosing the Power Source.

The most common sources of power for an automated valve are electricity and fluid power. If electric power is selected, a three-phase supply is required for large valves (usually on pipes 18 inches and above); however, for small valves (on pipes below 18 inches), a single-phase supply may be sufficient.

Usually an electric valve actuator is able to accommodate any of the common voltages. Occasionally, such as with power plants, 24-volt DC supply is available and sometimes preferred for emergency operating or black start operation. Rotork is capable of providing DC-powered actuators.

The variations on fluid power are much greater. First, there are the varieties of fluid medium, such as compressed air, nitrogen, hydraulic fluid, or natural gas to consider. Then, there are the variations in the available pressure of that medium. With Rotork's line of fluid power products, almost all of those variations can be accommodated; however, there are some effects on the size and cost of the actuator that need to be considered.

The higher the applied pressure of the fluid medium, the smaller the required cylinder. Typically, smaller cylinders are less expensive for any given fluid medium.

If you have a choice of power supply, Rotork can provide budgetary figures comparing electric motor operators with fluid power operators, so a cost-based decision can be made.

2. Examining the Valve Type.

At the inception of the retrofit project, the valve type needs to be known so that the correct type of actuator can be selected. As we mentioned, some valves need multi-turn inputs whereas others need quarter-turn. This has a great impact on the type of actuator selected and, when considered with the power supply available, a rational selection of actuator type can be made.

In general terms, multi-turn fluid power actuators are a more expensive solution than multi-turn electric actuators; however, for rising non-rotating stem valves, a linear fluid power actuator may be the suitable selection.

A definitive selection cannot be made until the power requirements of the valve are determined. After that decision has been made, then consider the criteria below.

3. Calculating the Torque Required by the Valve.

For quarter-turn valves, the best way of determining the torque required is by obtaining the valvemaker's torque testing data. Most valvemakers have measured the torque required to operate their valves over the 90 degrees of operation and make this information available for customers. In addition, Rotork maintains its own database of torque data for many manufacturers and can size actuators accordingly.

However, the situation for multi-turn valves is different. Multi-turn valves can be broken down into several groups:

- Rising rotating stem valves (most globe valves).
- Rising non-rotating stem valves (most gate valves).
- Non-rising rotating stem valves (some waterworks' gate valves).

In each of these cases, the measurement of the stem diameter together with the lead and pitch of the valve stem thread is required in order to size the valve. This information coupled with the size of the valve and the differential pressure across the valve can be used to calculate the torque demand.

Once we have the power supply defined, the type of valve, and the torque demand of the valve, then we can look at the available products that can automate that particular valve.

You can find a matrix that

Rotork has extensive testing and quality performance capabilities. The photo above shows an apparatus that tests the torque, life, and performance of spring return and double-acting fluid power actuators.

can assist you in making that selection in the Appendix of this booklet. The available products together with their torque range and power requirements are shown there.

4. Sizing the Actuator.

Once the actuator type has been selected and the torque requirement of the valve has been determined, then we can size the actuator using one of many available tools.

For fluid power actuators, we match the fluid pressure with the torque demand and read off the actuator size from the torque tables in Rotork's sizing guide (which is available by contacting Rotork).

Usually for fluid power operators, the speed of operation is not a critical issue, since the normal speed of operation of the actuator is fast enough for most applications. If necessary, fluid power actuators' speed of operation can be increased by using high-speed (larger capacity) control valves and piping. Conversely, it can be reduced by using the standard controls with the addition of flow control valving.

The speed of operation for an electric actuator, however, is critical to the sizing selection. On the Rotork IQ sizing table, the actuator model number is a function of valve torque demand and output speed of the actuator.

Perhaps the easiest way to size electric actuators is to use Rotork's CD catalog (which is available free of charge by contacting Rotork). The interactive CD allows actuator selection by range, then sizes the actuator based on valve torque demand. It also checks to ensure that the actuator can accept the valve stem.

Once the actuator has been selected, the CD will allow dimensional drawings and wiring diagrams to be automatically selected and printed out for reference. There is also an actuator order form, which can be faxed to Rotork to place an order.

5. Adapting the Actuator to the Valve.

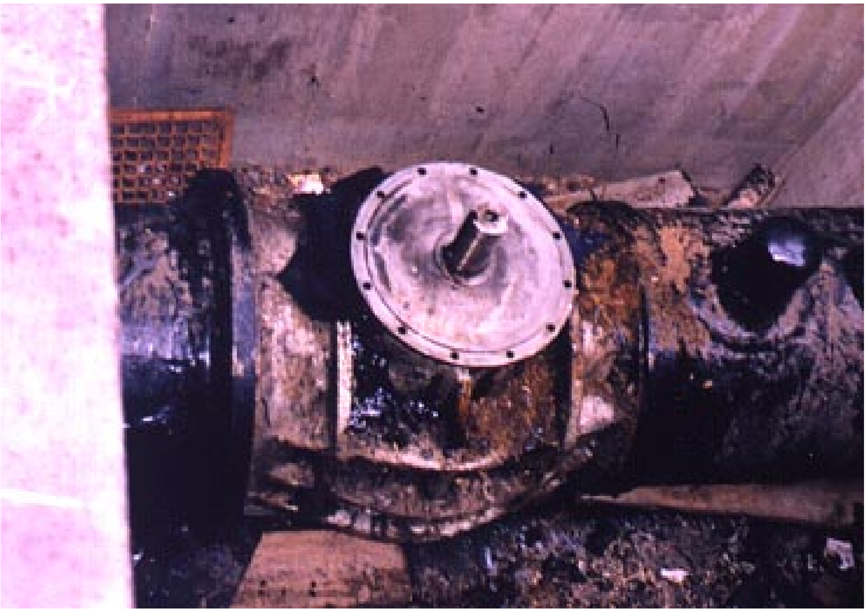
Having defined the actuator, we now have to consider how that actuator will be physically mounted onto the valve when it arrives from the factory. For this we need to design appropriate mounting bracketry, so that the weight and the torque reaction of the actuator is absorbed or supported by the valve.

First, the valve topworks need to be carefully examined and measured. There may already be some kind of mounting flange in existence that previously supported an old actuator or gearbox. This could be utilized to bolt an adaptation piece between the existing valve topworks and the actuator mounting base. Such an adapter can take many forms, such as a single or double plate adapter, a spool piece, or a piece of rectangular hollow section.

The bracket not only must be able to support the weight of the actuator, but it must also be robust enough to take the torque reaction and the thrust reaction of the valve. The valve topworks themselves must also be robust enough to support these forces. Needless to say, extensive experience is a benefit that comes into play in the design of the bracketry, which often is critical to the success of the retrofit.

Some valves have no flange at all onto which the actuator can be mounted. In those circumstances, a plate has to be welded in place or some other means of attachment needs to be utilized, such as a saddle bracket.

Another component that is essential to a successful installation is the torque transmission element, or drive bushing. On quarter-turn actuators, this is often a cylindrical intermediate piece between the valve stem and the actuator bore such that a keyway transmits the drive from the drive bushing to the



Pictured above is a valve topworks flange and stem onto which an adaptor and actuator will be mounted for a successful retrofit.

valve stem.

Most electric quarter-turn actuators have their blank drive bushing available for machining to suit the valve stem; however, fluid power actuators usually have a custom-machined drive bushing made to suit the actuator and valve stem. In either case, this component can be provided by Rotork.

For threaded valve stems, such as gate valves, the drive bushing is usually made of an aluminum bronze material that needs to be threaded with an exactly matching thread to the valve stem.

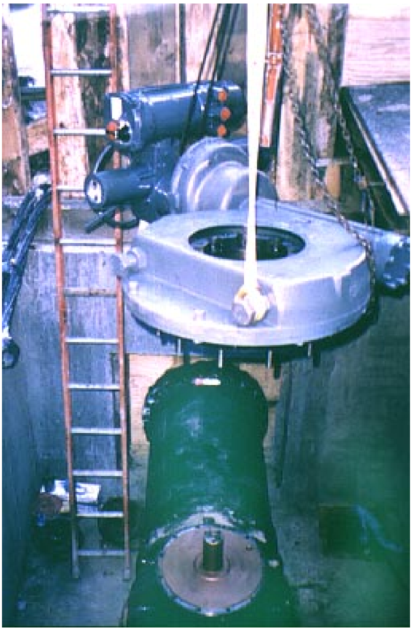
6. Mounting the Actuator onto the Valve.

In the mounting operation, the valve, actuator, and mounting adaptation come together to make the automated valve assembly. The physical mounting of the actuator on the valve requires the stem bushing to be mated with the valve stem while the actuator is lowered onto the mounting hardware. Once in position, the actuator can be secured by bolts to the mounting hardware and hence to the valve itself.

Once the actuator is physically in position on the valve, then the power supply can be connected to the actuator. On electric actuators, this requires conduit to be connected to the terminal compartment of the actuator, and the wires to be connected to the appropriate terminals in the separately sealed terminal compartment. Fluid power actuators require tubing containing the fluid power medium to be connected to the control cabinet or to the direction control valve associated with the fluid power actuator.

Once the power supply has been connected, then the limits of travel and other parameters can be set on the actuator.

For electric actuators, setup has been dramatically simplified with the advent of the IQ non-intrusive setting feature. This allows the limits of travel, torque setting, direc-



Actuator being mounted on valve.

tion of rotation, and other parameters to be set using an infrared setting tool to communicate with the actuator. During the setup procedure, no covers need to be removed, and hence no moisture or dirt can ingress into the electrical enclosure of the actuator.

Limits of travel on the AQ and Q quarter-turn electric actuators also can be achieved by adjusting the external mechanical travel stops located on the outside of the actuator. The same is true for fluid power quarter-turn valve actuators.

Details of setup procedures can be found in Rotork's technical manuals supplied with the actuator.

7. Testing and Commissioning.

Once the actuator has been mounted and the travel limits have been set, then, utilizing the local controls and a power supply, the operation of the valve can be tested locally.

The normal procedure for testing an electric operator is to move the valve into the "Mid" position, then press the **"**Open**"** button. Providing the power supply is connected correctly, the valve should move into the "Open" position until it reaches the end-of-travel and then stop.

However, if the actuator is connected to a three-phase supply and the phases are reversed, there is a danger that a conventional actuator would move in the opposite direction because of phase reversal. This is an extremely bad situation. It means the torque and position switches are in the wrong control circuit, and the valve could run to the end-of-travel and go into a stall condition causing damage to the stem or the valve seat.

Fortunately, this will not occur with a new Rotork actuator due to the inherent safeguard provided by Syncrophase, a feature which automatically selects the correct contactor to energize. Therefore, the motor will always run in the correct direction. The protection switches are always in effect and no damage can occur to the valve.

After the motor operator has run the valve in the "Open" and "Close" direction confirming correct seating of the valve and functionality of the automated valve package, then commissioning is completed, and we can turn our thoughts to remote operation.

CONTROLLING THE VALVE

The standard retrofitted valve can be controlled locally using the standard push-buttons supplied with Rotork electric actuators, or with the local control panel for a fluid

If phase reversal occurs, a bent stem (pictured above) can result. Rotork's Syncrophase feature prevents this from happening.

power actuator. But local control only provides us with a small part of the benefits of retrofitting.

A major benefit of using an automated valve actuator is the capability of remotely controlling the valve and gaining status on its condition at the control room.

1. On/Off Control.

The most basic type of control for an automated valve is that which tells it to be "Open" or "Closed." This easily can be achieved by running a pair of wires out to the actuator from the control room.

By applying a voltage across the wires, we can energize a contactor coil initiating motion in an electric valve actuator, or we can energize a solenoid coil causing a fluid medium to move a fluid power actuator. The presence of the voltage would tell the actuator to go one way, and the absence would tell it to go the other way.

This does not, however, allow us to stop the actuator at an intermediate position. In order to do that, we need three pairs of wires onto which we would apply a voltage signal to the first pair to tell the actuator to go "Open," the second pair to tell the actuator to go "Closed," and the third pair would tell the actuator to "Stop."

This basic control gives us the power to move the actuator from a remote position, such as from the control room. However, should the distance from the control room to the actuator be significant, then we would probably want to apply a DC control signal so that when we remove a control signal, there is no residual voltage due to capacitance, which could delay the removal of the signal at the actuator. For that reason, long distance control is often achieved with a direct current signal.

As yet we have only discussed how to tell the actuator to move, we have not examined the means of confirming that the actuator is in the desired position. Both electric and fluid power actuators are equipped with position indicating switches that trip at the ends-of-travel. We can therefore run another two pairs of wires to the actuator – one to give us “Fully Open” indication, and the other to give us “Fully Closed” indication.

If continuous position indication is required, then a continuous position transmitter could be fitted to the actuator using two or three wires so that a 4-20 mA position indicating signal is received at the control room. We now have ten control and indication wires running from the control room to each actuator to give us “Open,” “Stop,” and “Close” control, and “Open” and “Closed” or “Continuous Position” indication.

2. Modulating Control.

If the requirement is to have the actuator positioned at some intermediate position so a process is controlled, then a positioning type of control is required. There are fundamentally two types of positioning controls; the first uses intelligence in the actuator, and the second uses intelligence in the control room. In the first instance, a position controller is placed in the actuator. In this case, when a 4-20 mA positioning signal is transmitted from the control room to the actuator, it positions the valve in proportion to the signal. For example, a 12 mA signal would position the valve in the “Mid” position.

The second type of control uses a PLC or other host computing device to energize the actuator “Open” or “Close” control until the desired position feedback is received from the actuator via the continuous position transmitter.

In the first option where the actuator has its own positioner, the movement of the actuator can be restricted using a built-in time delay and dead band controls. For this reason, standard type actuators can be used for positioning duty; however, for constantly modulating duty, special modulating actuators are available (IQM, AQM, and so forth).

3. Digital Communication Systems.

The previously described controls function perfectly well, but, because of the length of cabling required to connect actuators to the control room, the cost of cabling, conduit, and labor can be astronomical. A simpler method of connecting actuators to the control room uses Rotork's Pakscan technology which consists of a signal generating master station that communicates over a two-wire shielded twisted pair loop to field units located inside of the actuators around the plant.

The master station generates digital signals which are addressable to each actuator, so each or every actuator can be commanded to “Open,” “Close,” or go to any position. Over the same two wires, actuator position can be reported back to the master station for each of the actuators.

Two-wire control can perform all of the functions of the standard hard-wire control, and enables the examination and communication of additional information in each actuator over the two-wire loop. For example, the status of the following can all be brought back over the two-wire loop:

- Torque Switch
- Limit Switch
- Thermostat
- Local/Remote Controls
- Contactors
- Power Supply.

In addition, the master station can check every actuator every few seconds to ensure its availability for operation. This is the scanning part of the Pakscan system.

Should a break occur in the two-wire loop, then the master station immediately detects the fault and reconfigures the loop into two branches. This gives the Pakscan system single fault tolerance.

The Pakscan master station connects to the host control computer via an RS-485 or RS-232 Modbus RTU link. This enables the programmer to have a proven interface between his host computer and the Pakscan equipment. Rotork Pakscan systems have been successfully interfaced with all of the major international DCS and PLC manufacturers.

4. Stand-alone Control Intelligence.

If no host computer or intelligent control devices are used, then Rotork can provide two methods of intelligent control. The first is our Pakscan IIS master station, which has inherent programmability enabling sequences and interlocks to be preprogrammed in the master station. These sequences can be initialized using push buttons mounted on the face of the master station.

Because the master station is watertight, it can be located in operational areas, so that visual monitoring of the process can take place while

The Pakscan IIS master station is water-tight and can be located indoors or outdoors.

standing at the master station controlling the process. The IIS master station can also be linked to a host computer via an RS-232 or RS-485 Modbus RTU link.

The other control option is to utilize a standard IBM-compatible PC with Rotork's PakVision software. This software allows for control of individual actuators, programmable sequences, and programmable interlocks, as well as a visual display using mimic diagrams of the actuators in the plant. Record-keeping logs are also part of the software to track operator actions, changes in the plant equipment, and alarms.

5. Startup and Commissioning of Control Systems.

The first step in commissioning a remote control system for the Rotork actuators is to locally commission the actuator to ensure correct functionality at the automated valve. Only then should remote control commissioning take place.

For conventional hardwired systems, functionality of each control and position feedback should be checked sequentially, preferably with a technician at the valve and a technician in the control room to initiate and confirm control commands. In the event of a problem, then the continuity of the wiring and wiring connections should be systematically checked, as well as the functioning of control and indicating switches.

Commissioning a Pakscan system fortunately is significantly less complex. After the commissioning of each valve locally, the continuity of the two-wire loop should be checked. Because it is a “daisy chain,” the loop is a relatively straightforward check compared to a multi-strand hard-wire system.

Because the Pakscan IIE and IIS master stations are stand-alone communication devices, there is no need to have PLC or DCS host connections made in order to commission the system. Using the keypad on the front of the master station, each valve can be addressed sequentially and the operation and communications checked, again preferably with a technician located at the valve itself.

The master station has a diagnostics capability, so faults can be specifically identified in the control room.

Once the host DCS is connected to the master station, the incoming signals from the host can be monitored at the master station for complete diagnostics.

However, if the master station has previously been used to commission the loop, then faults should be confined to software commands and responses.

SUMMARY

Today’s automated valve actuators and two-wire communication systems can be cost-effectively installed and retrofitted in virtually any type of facility. Automated valve operation provides an array of important benefits, including:

- increased plant effeciency
- decreased labor costs
- improved safety
- more effective control
- the flexibility to add additional monitors and alarms
- less chance of operator error
- less risk of injury to personnel
- increased environmental protection, and more.

Most important, even very old and small plants can enjoy these benefits by retrofitting.

In fact, today’s valve actuator technology is so affordable and dependable that manual operation is fast becoming outdated and is relevant for only a few types of applications.

FOR MORE INFORMATION

For more information, contact:

Mr. Chris Warnett
Rotork Controls, Inc.
19 Jet View Drive
Rochester, NY 14624 U.S.A.
Telephone: 716-328-1550
Fax: 716-328-5848
Email: info@rotork.com

Rotork’s website address is **http://www.rotork.com**, which can be accessed 24 hours a day.

Appendix
Rotork Actuator Selection Matrix – Electric

Electric Actuators	Description
IQ Multi-turn	3-phase (eg., Gate or Globe Valves) 10 to 2,200 ft. lbs. torque
IQM Multi-turn Modulating	3-phase (eg., Gate or Globe Valves) 10 to 200 ft. lbs. torque
A Multi-turn	3-phase, 1-phase, and DC (eg., Gate or Globe Valves) 10 to 2,200 ft. lbs. torque
A or IQ with IB or IS Gearboxes Multi-turn	3-phase (eg., Gate or Globe Valves) 12 to 24,000 ft. lbs. torque
A or IQ with IW Gearboxes Quarter-turn	3-phase (eg., Ball, Butterfly, or Plug Valves) 288 to 100,000 ft. lbs. torque
AQ Quarter-turn	3-phase, 1-phase, and DC (eg., Ball, Butterfly, or Plug Valves) 40 to 800 ft. lbs. torque
AQM Quarter-turn Modulating	3-phase, 1-phase, and DC (eg., Ball, Butterfly, or Plug Valves) 40 to 800 ft. lbs. torque
Q Quarter-turn	1-phase (eg., Ball, Butterfly, or Plug Valves) 40 to 300 ft. lbs. torque
G Multi-turn	3-phase (eg., Gate or Globe Valves) 1,200 to 5,000 ft. lbs. torque

Appendix
Rotork Actuator Selection Matrix – Fluid Power

Fluid Power Actuators	Description
P – Quarter-turn	40 to 250 psi, air, gas, hydraulic, water (eg., Ball, Butterfly, or Plug Valves) 2,680 to 2,000,000 in. lbs. torque
SP – Quarter-turn	40 to 250 psi, air, gas, hydraulic (eg., Ball, Butterfly, or Plug Valves) 655 to 5,090 in. lbs. torque
PAW – Multi-turn	80 psi, air or gas (eg., Gate or Globe Valves) 16 to 300 in. lbs. torque
PAW/IW – Quarter-turn	80 psi, air or gas (eg., Ball, Butterfly, or Plug Valves) Torque on application
PL – Linear	40 to 250 psi, air or gas (eg., Gate or Globe Valves) Thrust on application
H – Quarter-turn	250 to 3,000 psi, hydraulic (eg., Ball, Butterfly, or Plug Valves) 1,215 to 2,000,000 in. lbs. torque
HPG – Quarter-turn	250 to 3,000 psi, gas (eg., Ball, Butterfly, or Plug Valves) 2,680 to 2,000,000 in. lbs. torque
HPL – Linear	250 to 3,000 psi, air or gas (eg., Gate or Globe Valves) Thrust on application
R – Quarter-turn	20 to 125 psi, air or gas (eg., Ball, Butterfly, or Plug Valves) 45 to 10,500 in. lbs. torque