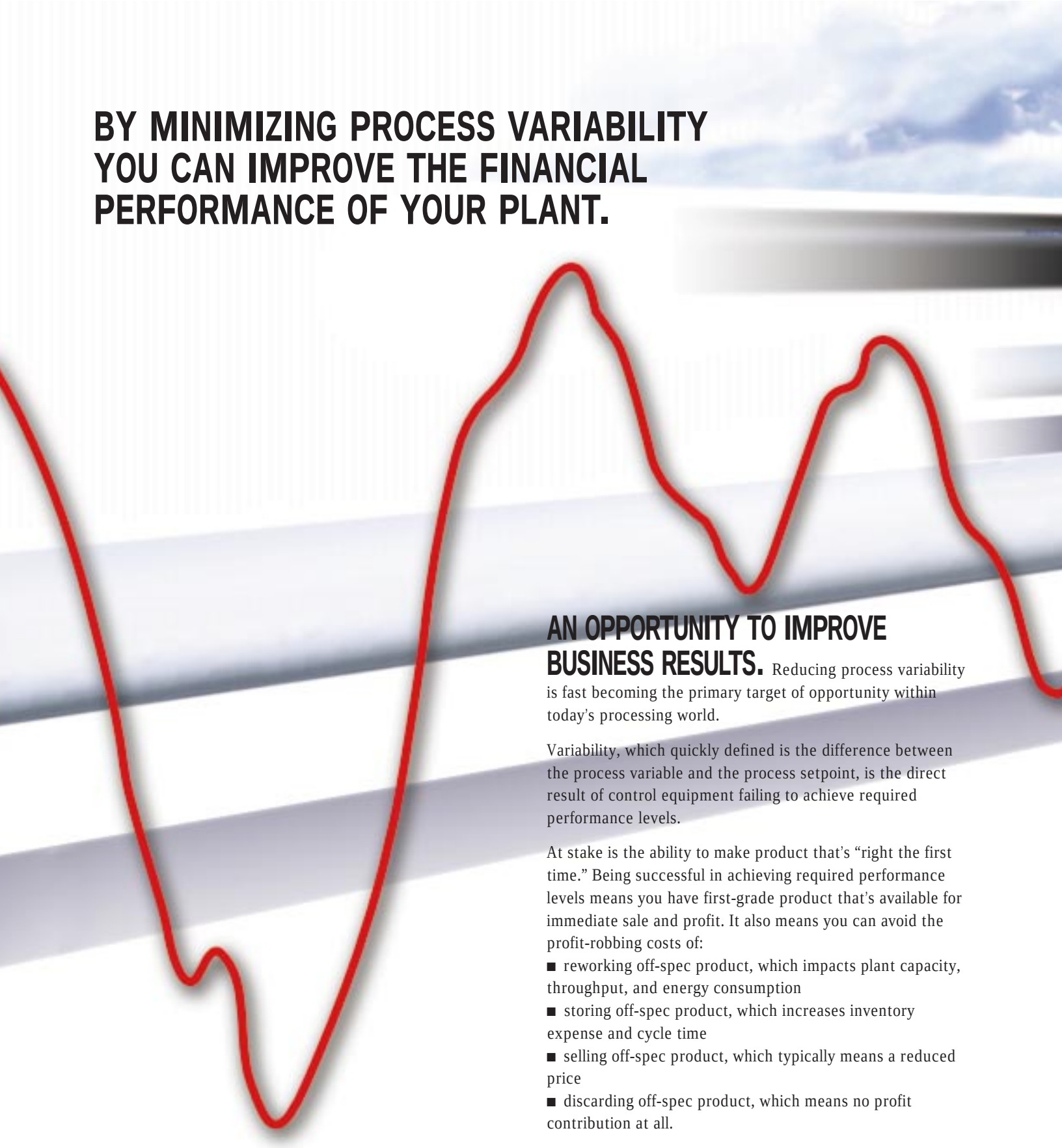
THINK OF THIS AS A PROFIT OPPORTUNITY.

FISHER®

FISHER-ROSEMOUNT™ Managing The Process Better.℠

BY MINIMIZING PROCESS VARIABILITY YOU CAN IMPROVE THE FINANCIAL PERFORMANCE OF YOUR PLANT.



AN OPPORTUNITY TO IMPROVE BUSINESS RESULTS.

Reducing process variability is fast becoming the primary target of opportunity within today's processing world.

Variability, which quickly defined is the difference between the process variable and the process setpoint, is the direct result of control equipment failing to achieve required performance levels.

At stake is the ability to make product that's "right the first time." Being successful in achieving required performance levels means you have first-grade product that's available for immediate sale and profit. It also means you can avoid the profit-robbing costs of:

- reworking off-spec product, which impacts plant capacity, throughput, and energy consumption
- storing off-spec product, which increases inventory expense and cycle time
- selling off-spec product, which typically means a reduced price
- discarding off-spec product, which means no profit contribution at all.

As these examples suggest, by minimizing and controlling process variability there is opportunity to improve your plant's financial performance.

But how do you control variability? We think the following insight on control valve performance will help you decide.

THE CONTROL VALVE, A CONSENSUS WORST OFFENDER. There are many causes of process variability, ranging from the improper design of a control system, to individual instruments being out-of-tune, even to using a flawed control strategy to run a manufacturing process.

Despite these many potential variability sources, from within industry there emerges a primary "variability culprit," the control valve.

Today, almost across-the-board, the control valve has been identified as the leading source of off-spec product, reduced throughput, increased chemical usage, plus a host of process control ills that drive operating costs up…and operating profits, down.

The findings of process control analysis experts, which are based upon audits of thousands of flow control loops, show that as high as 40% of all variability is caused by poorly performing control valves.

The experiences of those who work directly with control systems and control valves support the conclusions of formal system analyses. At a recent instrumentation symposium, attendees from such leading processing companies as EXXON, Conoco, DuPont, Union Carbide, and others identified the control valve as the "worst offender" against the dual criteria of being within control and impacting uptime. Other variability sources identified include input/output (I/O) devices, instruments, and process design, but to a lesser extent.

EXAMPLES: HOW REDUCING VALVE VARIABILITY BOOSTS PROFITS. Most companies realize that they have a huge economic stake in seeking opportunities that have the biggest positive effect on business results. Reducing process variability caused by control valves is one of these opportunities, and as these examples show, driving control valve variability to its minimum can have a significant impact on operating profit:

Pulp and Paper—A northern mill installs a Fisher Vee-Ball® valve to improve headbox flow control . . . improves sheet formation quality ten-fold, increases production by 1.4%, and achieves a $1-million increase in value over one year.

Chemical—A Houston area chemical plant utilizes Fisher butterfly valves on a bottle neck reactor to reduce air pressure variability from 15% to 1%. Achieves a 10% increase in reactor production.

Power—A midwestern utility installs Fisher globe valves developed specifically for its de-superheater bypass system… results include better control with fewer turbine trips, leading to costs savings that exceed $1-million annually.

Hydrocarbon—A refinery installs Fisher instrumentation on the main hydrogen control valve to a first-stage hydrocracking reactor. Unit production increases 1000 barrels per day, worth over $1.4-million annually.

CONSIDER PERFORMANCE PARAMETERS IN VALVE SELECTION. Control valve, and therefore, process performance begins with proper valve selection and sizing. Which means you need specific information on pressure conditions, flow rate, required response time, plus process temperature, viscosity, and fluid makeup.

Other required input includes fail action, shutoff requirement, plus any additional control parameters which must be met.

These are the traditional valve selection criteria which allow choosing a valve that, in many cases, will be all that you need to achieve the desired performance level.

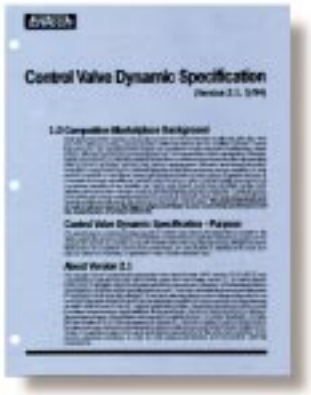
However, today's drive for improved financial performance means going beyond traditional valve selection methods. It also means that a valve in a critical loop must meet performance levels that ensure a minimum in process variability.

An unnecessary requirement? Not when you realize that variations in design from one valve manufacturer to the next can mean a 30% to 50% difference in variability. Such a difference literally means hundreds of thousands of dollars in operating revenue, as demonstrated in "A VALVE PROFITABILITY EXAMPLE."

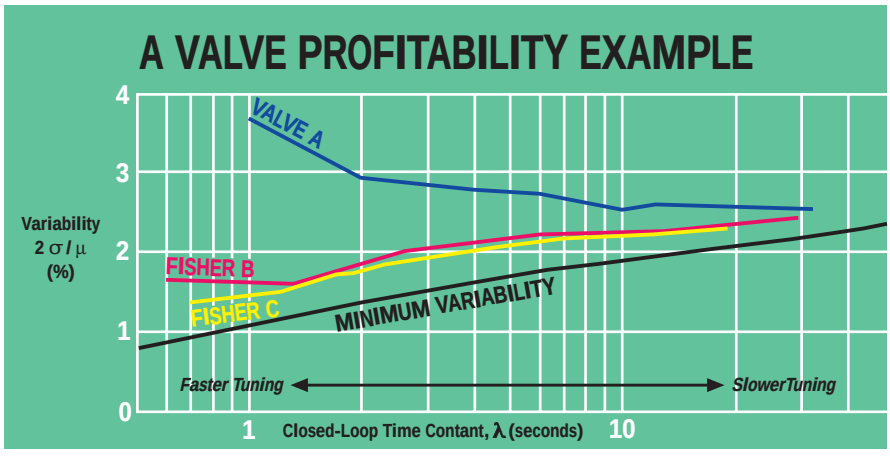
PERFORMANCE SPECIFICATIONS. AN EXAMPLE TO FOLLOW. A good starting point in your efforts to minimize variability is to establish a specification which details the operating performance you require from control valves.For example, one such performance specification has been developed by EnTech Process Control of Toronto, Ontario. The key parameters of the EnTech "Control Valve Dynamic Specification" are highlighted below. Utilize this specification or a similar one in your valve selection process, and then base each future control valve selection on installed performance characteristics.

Summary of the Control Valve Dynamic Performance Specification[1]

- Combined backlash/stiction (dead band): Not to exceed 1% of input signal span.
- Speed of response: Rate of change of valve position in response to step changes ranging in size from 10% in input signal down to the backlash/stiction (dead band) limit plus 1%.
- Overshoot: Percent overshoot in valve position to be less than 20% for all steps made.
- Sizing and Flow Characteristics (Engineering Design): Loop process gain (% transmitter span ÷ % controller output) = 1.0; nominal range = 0.5 - 2.0.



Note 1: Developed by EnTech® Control Inc., Toronto, Ontario



Evaluating control valve assemblies under closed-loop conditions provides the only true measure of variability reduction.

The closed-loop test results above demonstrate the ability of three, globe-style control valves to reduce process variability over a range of tuning conditions.

Valves B and C (both Fisher units) closely parallel the minimum variability line (which represents an "ideal" valve) indicating excellent dynamic performance.

In contrast, Valve A (brand X) departs quickly from the ideal performance curve as system tuning becomes faster.

The economic impact of Valve A versus Valve C is demonstrated by this example: At a closed-loop time constant of 3, the difference in variability between Valve A and Valve C is 0.9%, which at the test flow rate of 600 gpm equates to a daily difference of 7776 gallons.

If that difference involved a raw material with a conservative value of 35 cents per gallon, the Fisher valve would contribute $2722 per day directly to profits. Which adds up to an impressive $994,000 profit advantage in one year!

Performance of the Fisher valves in this example gives strong evidence that a superior control valve can have a significant impact on profitability.

VALVE DESIGN, IT IMPACTS PERFORMANCE. As part of your valve selection process, it's important to recognize that valve type and valve brand can have significant impact on performance.

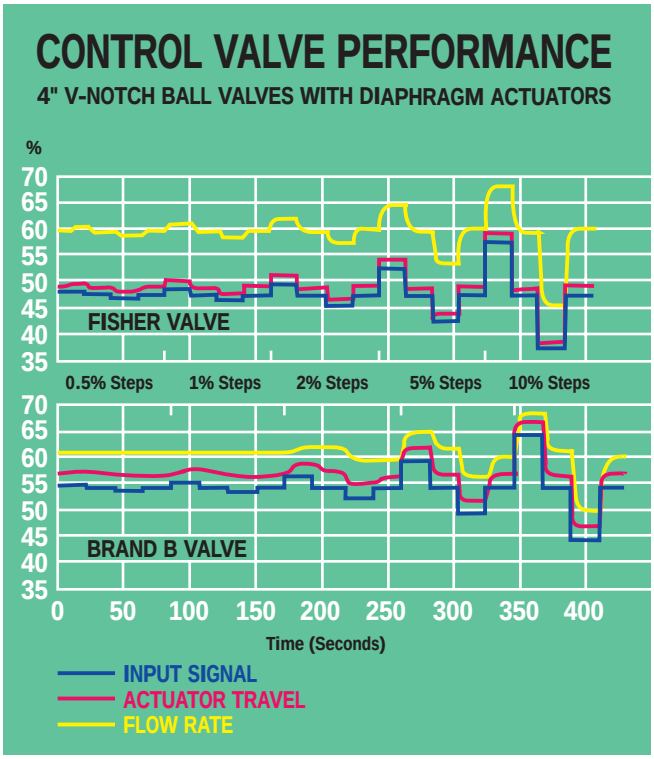
For example, we know that control valves do not perform at the same level from one style to the next (i.e., V-notch, globe, ball, and butterfly) let alone from one manufacturer to another.

We've gained this insight through years of field experience and have verified our findings by subjecting different valve constructions to rigorous closed loop testing.

In fact, we've dedicated three flow loops solely to the study of valve performance. Utilizing closed loop performance tests, our research engineers (who are highly qualified and experienced control specialists) have built an extensive knowledge base concerning which control valves are the most effective at reducing process variability.

A quick review of a "step test" as shown below illustrates typical findings.

Comparing the response of two V-notch ball valves (one a Fisher valve, the other a purported equal) to step changes in input signal reveals a significant difference.



Utilizing flow loops which are dedicated full-time to performance testing, we have evaluated the control capabilities of Fisher rotary and globe valve designs as well as that of other control valve brands. In head-to-head comparisons, Fisher valves simply out-perform the competition. Closed loop performance evaluation proves it.

Our performance verification flow loops are the first in the control valve industry to be certified by EnTech Process Control as being in compliance with its Control Valve Dynamic Specification. (Certification was granted following an audit of test procedures, process measurement instrumentation, signal conditioning, and data acquisition methods.) This certification becomes increasingly significant as processing industries, such as pulp and paper and chemical production, now apply the EnTech dynamic performance specification in their control valve selection procedures.

The Fisher valve initiates accurate actuator travel and flow rate changes in response to 0.5% step changes. Valve B shows inaccurate actuator response at a 2% step change with a degree of flow accuracy beginning at 5%.

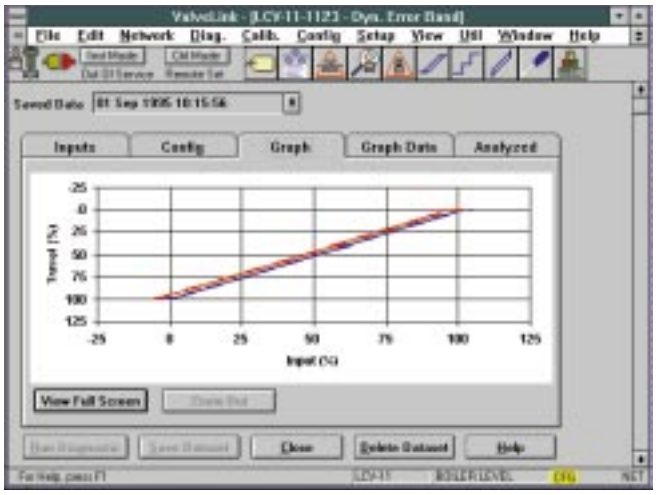
In the majority of closed loop tests, Fisher control valve assemblies simply outperform the competition.

In explaining why, we give credit to these Fisher strengths: Product design superiority which brings such mechanical attributes as minimal dead band; the use of high-performance positioners to ensure fast response; accurate valve sizing; and application guidelines which combine with the inherent advantages brought by years of process control experience.

KEEP YOUR PERFORMANCE ADVANTAGE. A lot of effort and expense go into the design and building of a process control system. The latest control technologies and equipment typically are employed to reach maximum yields, achieve tight conformance to product specifications, and gain maximum efficiencies.

You've seen how it makes little sense to install or upgrade a control system with DCS and smart instrumentation without utilizing valves which control variability.

While selecting the right control valve is key to improving your plant's overall profitability picture, and getting the most



The "health" of a control valve which is equipped with a FIELDVUE digital valve controller can be checked quickly. Using ValveLink software with its point-and-click operation, the valve's operating signature curve can be generated and compared with prior test results, all within minutes. Deviation from earlier results may indicate the need for maintenance.

out of a control system means keeping processing equipment in peak operating condition, what steps can you take to ensure continued control valve and process performance?

To start, utilize control valve diagnostics.

Today's micro-processor based diagnostics advantage offered by the Fisher FIELDVUE® digital valve controller as well as the Fisher FlowScanner™ valve analysis system means you literally can evaluate the performance of a control valve with the click of a button.

The valve-mounted FIELDVUE digital valve controller with its ValveLink® operating software provides real-time monitoring of a valve's operating health and allows the comparing of current operating status versus a historical database of performance.

This comparison helps you spot emerging valve repair requirements before they impact performance and lets you develop timely maintenance plans.

Besides monitoring the operating health of an individual control valve, ValveLink software lets you communicate with multiple FIELDVUE instrument-equipped control valves. With its continuous scanning capability, ValveLink software can monitor and log alerts from every FIELDVUE digital valve controller, giving you a plantwide valve maintenance system.

For valves not equipped with a FIELDVUE digital valve controller, you can utilize the Fisher FlowScanner™ system for a detailed, pinpoint analysis of control valve problems. Its capabilities let you identify trouble points such as inadequate seat load, worn seat rings, insufficient or excessive packing loading, plus a host of possible control valve ills.

The FlowScanner diagnostic system provides a non-intrusive look at the operating condition of the control valve and lets technicians pinpoint internal parts damage.

Relying on the FIELDVUE digital valve controller and the FlowScanner system means you can determine a valve's operating condition, make informed decisions on maintenance needs, and then schedule repair activities for the least disruptive time. Importantly, this analysis proves just as valuable in identifying valves which perform to requirements as it does in identifying valves that need repair. By avoiding unnecessary valve repairs, you avoid extra maintenance costs.

YOUR PERFORMANCE MAINTENANCE ADVANTAGE. In the battle for performance and production, you need every advantage you can get, such as the control valve analysis and maintenance services offered by Fisher and its service arm, the Fisher Service Company.

Fisher Service Company provides an extensive lineup of control valve maintenance and repair services, including on-site analysis utilizing the FlowScanner diagnostic system, valve repair onsite or at the Company's nearest service center, FAST Parts service for quick parts delivery, plus valve maintenance consulting and instruction, to name just a few.

CONTROL VALVE ANSWERS, PUTTING IT ALL TOGETHER. Utilizing control valves that minimize process variability goes a long way toward favorably impacting financial results. But as you've seen, choosing the exact valve for each critical application is not always easy.

However, there is an answer. By relying upon the high performance capabilities of Fisher control valves, you gain the confidence that process variability is under control.

Our on-going performance evaluation testing demonstrates the superiority of Fisher control valves, while the process control enhancements and financial improvements being realized by our customers confirm our findings.

Today, control valve maintenance is a lot easier thanks to the diagnostic capabilities of FIELDVUE digital valve controllers and the FlowScanner maintenance analysis system.

And keeping your control-valve-created profits in place can become automatic by relying on the performance maintenance program offered by the Fisher Service Company.

Now you can reduce process variability and realize profit gains by specifying Fisher control valves and services. Contact your local Fisher sales representative or sales office for the details…and start thinking of your control valves as "profit opportunities."

PROCESS MANAGEMENT GIVES DRAMATIC BREAKTHROUGHS. Care and management of equipment assets can bring you huge maintenance savings and higher process yields.

Fisher-Rosemount PlantWeb™ architecture with its PERFORMANCE software for asset management helps provide the information you need to manage your process equipment. So you slash downtime and make unneeded service a thing of the past. And importanty, you keep assets performing better so you can cut variability and increase yields.

Today, process management is no longer just process control. Now it also means gathering and using a wealth of new information from such assets as intelligent transmitters, valves, analyzers, and more. These intelligent field devices can talk to each other and to you, so you can monitor and manage the equipment running the process for peak performance and dramatic reductions in downtime.

You can configure, calibrate, monitor, perform diagnostics, and maintain records from anywhere in the plant, while the process is running. The information is brought to screens via familiar, Windows-based software, offering a common look and feel.

PlantWeb architecture with PERFORMANCE software melds asset management with process control to give you the information, control, and management capabilities you need to increase performance levels and lower costs.

Today's new emphasis on equipment management is yielding improved operating results for processing and energy companies, worldwide.

Form 8596 / Printed in the U.S.A. / 20M / 11-96

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