Frequently Asked Question:

"Do I need external Control Valve Diagnostics? My control valves are equipped with smart positioners and I have an Asset Manager."

The function of critical process components must be verified to meet modern reliability engineering and industrial maintenance best practices.

Can the Smart Positioner fullfill this role? Does the Smart Positioner eliminate the need for external valve diagnostics testing?

Consider the following:

1. Valve Positioner is Part of the Valve System Being Tested

Is it appropriate for a component of the system under test to be used to verify proper operation – of itself? Or should an independent system be used?

2. Positioner Exposed to Harsh Environment, Wear and Tear

Would a plant maintenance manager agree to have his critical control valves tested by a valve diagnostics test system stored for the previous year in the same harsh environment that the plant control valves are exposed to? *Highly unlikely.*

It would be perfectly reasonable to insist that the diagnostics system be checked for proper operation and certified accuracy prior to any testing.

However, in the smart positioner self-test scenario, the valve positioner electronics and transducers providing the diagnostics data have been exposed to that same harsh operating environment for possibly many years without independent verification or accuracy testing. Is this acceptable?

3. Positioner is not a calibrated, traceable instrument. Its accuracy, resolution and sensitivity are unknown.

Is it appropriate to employ an uncalibrated device with unknown accuracy, unknown resolution and unknown sensitivity to perform this critical component performance verification?

A proper, external valve diagnostics system is a NIST calibrated instrument employing transducers of known accuracy, sensitivity and resolution.

Smart positioners are simply *not calibrated* as a NIST calibrated instrument. In addition, the installation and maintenance manuals (in some cases almost 400 pages long) provided by smart positioner manufacturers do not contain information describing the accuracy, sensitivity or resolution of these devices. (1)

4. On-Line Diagnostics are Limited; Comprehensive Control Valve Diagnostics are Only Available Off-Line.

Comprehensive Control Valve Diagnostics is sometimes confused with on-line valve monitoring or limited "Performance Diagnostics"

While a valve is active and in-service, smart positioners can record the distance the control element has traveled, and similar parameters which can be logged to set limits and alarms. It is further possible to make small movements of the control element for diagnostics purposes and not disturb the controlled process.

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1 - Emerson Fisher, Fieldvue™ DVC6000f Series, Instruction Manual, Form 5774, March 2006

These small motions can be analyzed and extrapolated to estimate certain valve performance parameters. This limited analysis is commonly referred to as *"Performance Diagnostics"*.

> *"While all diagnostics can be run while the valve is inline, only the Performance Diagnostics can be performed while the valve is in service and operating."*
>
> *Emerson Fisher, Fieldvue™ DVC6000 Series Digital Valve Controllers Product Bulletin 62.1:DVC6000 July 2006*

To generate control valve "signatures" or thoroughly analyze the control valve it is necessary to test it off-line where full signal, controlled excursions of the control element can be made.This valve testing is known as *Control Valve Diagnostics* or *"Advanced Diagnostics"*. To make direct comparisons to "as manufactured" valve signatures it is necessary to complete this off-line or out of service testing.

> *"…Advanced Diagnostics vary the digital valve controller set point and plot valve operation to provide insight into the dynamic performance of the valve/actuator assembly. Advanced Diagnostics include out-of-service diagnostics such as valve signature, dynamic error band, and step response that will assist in the identification of emerging valve problems quickly and accurately."*
>
> *Emerson Fisher, Fieldvue™Instrumentation AMS ValveLink Software Product Bulletin 62.1:ValveLink May 2005*

6. Does Control Element Motion Need to be Measured?

Is the accurate measurement of control element movement needed?

Smart positioners estimate control element travel by displacing the control element from one hard travel stop to the opposite hard travel stop. The number of counts observed by the input encoder or the resistance change of the potentiometer is recorded and divided by the operator input *Nominal* or *Rated Stroke* of the valve. Some positioners offer an option for the operator to enter the actual measured displacement (if known) rather than the estimated nominal value.

Since an external valve diagnostics system uses a displacement transducer actually calibrated to distance, it determines actual measured control element movement. If this movement is incorrect, improper trim is indicated and a possible costly valve assembly error is identified early.

7. Linkage Play, Wear or Deadband Cannot be Determined by Smart Positioner

Is is important to evaluate the feedback linkage from the valve stem or shaft?

A smart positioner does not make an independent connection to the stem or shaft of the control valve. It must rely on movement of its input encoder or potentiometer by the actual linkage under test. It only is aware of the movements of the positioner input and cannot know of movement lost due to problems related to the feedback linkage.

Therefore, it cannot detect linkage wear, play or other input deadband.

An external control valve diagnostics system makes an independent connection to the valve stem or shaft and can accurately evaluate this critical control link.

8. Input Signal Delays are Not Measured

Is measuring valve response as the plant control system sees the valve, important?

A smart positioner cannot detect when the control signal is applied by the controller. It only knows when a control signal is decoded into the processor. Delays related to its

signal conversion process cannot be detected. In some cases this delay can be significant and is certainly seen by the plant controller.

9. Auto-Setup Requires Verification

Conventional analog postioners require a tedious and time comsuming manual setup.

In a significant improvement in valve technology, smart positioners replace this manual process with an automated configuration. However, much of this automated process is behind the scenes and often the operator only gets a final green, yellow or red light indicating either success or failure of the process.

A simple external check to verify this setup can save a lot of time if it detects unreported problems or misconfigured valve setups early.

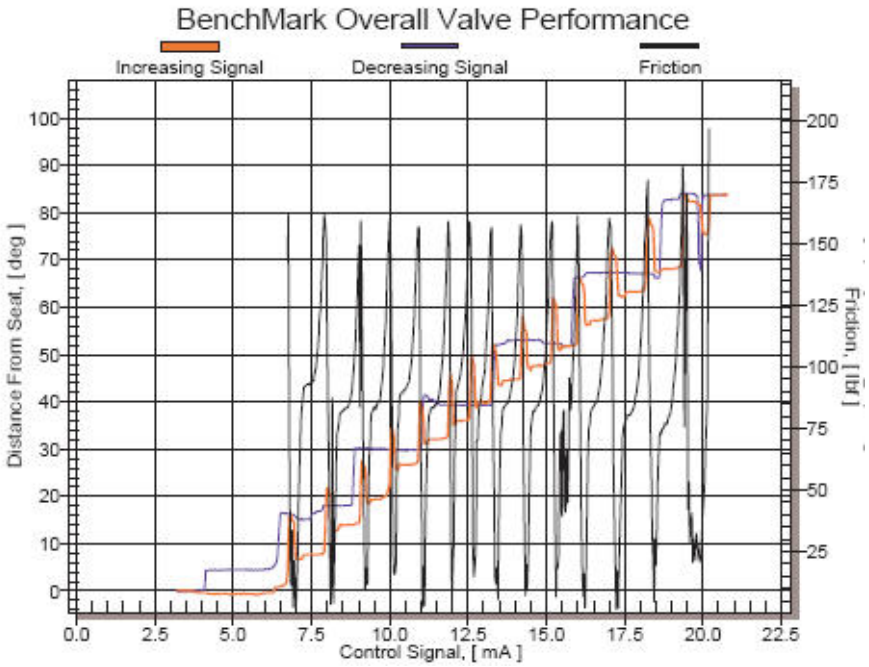
10. Auto-tuning Requires Verification

Similarly, many smart positioners go through an automated tuning process. Since this tuning is performed on the bench or after initial installation but without process pressure and temperature, it represents a very conservative situation for the valve.

A valve failing this tuning is very unlikely to improve or perform in service.

Without external testing, it is not possible to determine whether this setup is successful until the valve is fully installed and the loop brought into service. By then, *you may have bolted in a serious problem*.

The following figure shows the results of an external valve diagnostics testing of a smart positioner as delivered by a major valve manufacturer. It was tested after “successfully”, according to its internal diagnostics, passing Auto Setup and Auto Tuning.



Needless to say, there is a problem. Manual tuning adjustment corrected it. A simple external check to verify valve tuning can save a lot of time and money by detecting poor valve tuning before the valve is bolted in.