KUWAIT SECTION

JULY
NEWSLETTER 2009

INSIDE THIS ISSUE

- TECHNICAL WINDOW
- MEMBERS AREA
- NEW PRODUCT

FROM SECTION PRESIDENT'S DESK

I am pleased to release the July 2009 Newsletter of ISA - Kuwait Section.

We invite ISA Members and other Automation Professionals to contribute articles to be published in this newsletter.

Please send your feedback about your expectations of ISA - Kuwait Section to

kuwait-section@isa-online.org

Best Regards

Ali H Al Hashemi
President
ISA - Kuwait Section

ISA KUWAIT SECTION OFFICE

Ali H Al Hashemi
President
Kuwait National Petroleum Co
a.hashemi@knpc.com

Ali H. Alawadhi
Vice President
Kuwait National Petroleum Co

ah.awadhi015@knpc.com

PP Muthu
Secretary
Rezayat Trading Co Ltd
Office 24816836 Ext. 146
Cell 9437119
muthu@rezayatkwt.com

C. Dakshinamurthy
Treasurer
Kuwait Oil Co
Office 23822713
dakshinamurthy@kockw.com

Chandra Sekhar, S
Membership Chair
Kuwait Oil Co
chandras@kockw.com

Editorial Board

Invitation to Members

We invite interested ISA members to write anything about Automation to be published in this monthly Newsletter.	We invite IA&C Manufacturers and their representatives to use this newsletter to advertise their product offerings.

USE OF DIGITAL TECHNOLOGY TO TEST SHUT DOWN VALVES FOR SIS APPLICATIONS

Riyaz Ali

Final Element of Safety Instrumented Function (SIF) loop is a key component to take process to safe state, in the event of "Safety Demand". Unlike Logic Solver or Sensor (Analogue transmitters), which can be tested on line continuously, Final Element, requires total shutdown to check its mechanical integrity. With the invent of Digital Valve Controller, "Final element", mechanical movement can be tested on line, by moving 10 or 15% without disrupting the process.

INTRODUCTION

Recent and past accidents in the process industries especially those in the hydrocarbon, chemical, oil & gas industries, have caused great concerns towards functional safety to protect personnel, environment, equipment, property, business, organization image etc.

The Standards [i]IEC61508 as "an umbrella" document and IEC 61511 as industry specific versions, specifically dealing process industries provide guidelines for Safety Instrumented Systems to reduce the inherent risk of Safety Instrumented Function. SIF involve final element which could be emergency shut down valves, blow down valves, emergency isolation valves, emergency venting valves, on-off valves etc. These mechanical valves are not continuously moving. This could potentially pose a threat. Without movement, these stuck valves may possibly results in dangerous conditions leading to an accident. Conventional method of testing these valves requires either the plant be shut down, or mechanically locked in place to certain position for on line testing. Another alternate will be to put a bypass valve around. However, these methods are labor intensive, complex, not flexible, not economical and not risk free. The objective of this paper is to review customer pains and concerns in detail, and then demonstrate the use of digital valve controller improving the reliability and availability of safety function loop.

about author :
Director, Instruments Unit, MEA
Emerson Process Management – Fisher Divn, Dubai - UAE

INDUSTRY PAINS FOR FINAL ELEMENT TESTING

There are two basic ways for SIS systems can fail. The first one is commonly called a nuisance or spurious trip which usually results in an unplanned but safe process shutdown. The second type of failure does not cause a process shutdown or nuisance trip. Instead, it remains undetected, permitting continued process operation in an unsafe and dangerous manner. These failures are known as covert or hidden failures and contribute to the probability (PFD) of the system failing in a dangerous manner on demand.

The [ii]PFD_{avg} for the system is the sum of PFDs for each element of the Safety Instrumented Function.

Estimates indicate that more than [iii]50 percent of Safety Instrumented Function loop operational problems can be blamed on final control elements.

All components (Logic Solver, Sensor and Final Element) of Safety Instrument Function can be tested as integral loop or individually.

Final control element is typically a pneumatically actuated valve (valve body with actuator) operated by electrical on-off solenoid valve. Final Element receiving output signal from Logic Solver can be tested for its electrical signal integrity to solenoid valve during on line test. The valve body and actuator remain untested. Though IEC 61511 standards does not require integral test of all three components of SIF (Logic Solver, Sensor and Final element) except during PSAT (Pre Startup and Acceptance Test). However, as a good engineering practice integral periodical testing of complete SIF should be carried out.

THE CONVENTIONAL SOLUTION

The only sure way to completely test a final control element is with an in-line test that strokes the valve for full travel.

In the past plant turnarounds were scheduled every two to three years. However, with increased mechanical reliability and preventive maintenance programs, plant turnarounds are now extending to every five to six years.

In an attempt to get around this problem, many companies have devised methods for testing the SIS valves on-line so they do not have to shut down the process. The typical approach has been to install a bypass valve around each safety valve. It allows valve to test fully but despite the benefits, bypass approach has a number of disadvantages. Prime being process is left totally unprotected during test. Also, possibility remains leaving valve inadvertently in the bypass position after testing?

In an attempt to eliminate the operational and economic problems associated with bypass testing, other methods were developed. It was recognized that the most likely failure mode of valve is to remain stuck in its normal position. To test for this type of failure, it is not necessary to completely stroke. If a limited form of test can determine that the valve is not stuck, a large percentage of covert valve failures can be detected.

Over the years, a variety of methods have been developed for doing this type of partial testing. While all of them have a definite risk of spurious shutdown trips associated, the mechanical limiting method seems to be the most popular. Mechanical limiting methods involve the use of some mechanical device, such as a pin, a valve stem collar, a valve hand jack, etc. that will limit the valve travel to 15% or less of the valve stroke.

While these mechanical limiting devices themselves are rather inexpensive, the pneumatic test panels used to perform the test are complex and expensive.

The other method is logic solver based which send fixed pulsation to the solenoid valve to monitor the subsequent movement of valve. It does not provide any safe guard against spurious trip, until redundant or multiple solenoid valves are used. Whichever of these methods is chosen, procedures must be written to ensure that the shutdown valve is not tripped during testing, that the test is properly carried out, incorrect valve performance is documented, and that maintenance is performed to return the valve to its fully functional status.

POSSIBLE CONCERNS DURING PARTIAL STROKE TESTING OF FINAL ELEMENT

First and foremost concern of industry is availability of process while final element is tested on line. The test device, should offer protection against slam shut or nuisance trip. Also the partial stroke test result pass / fail should be available at HOST system level for corrective actions. The test procedures should be easy, simple, reliable, less manpower and flexible.

Also, customer need is to keep traces of event, when demand arises.

DIGITAL VALVE CONTROLLER AS REMEDY

Digital Valve Controller (DVC) has been in extensive use in recent years. These digital valve controllers are communicating (HART of Foundation Fieldbus), microprocessor-based current-to-pneumatic instruments.

Partial-stroke testing confirms the valve is working without disturbing the process. Because there is no need to shutdown the process during the test, testing can be done more frequently and flexibly. Partial stroke test can be initiated locally or remotely with or without human being. Test procedure can be programmed and stored into the memory of microprocessor, thereby eliminating any errors.

Typically the partial-stroke test moves the valve 10% from its original position but can be up to 30% if allowed by plant safety guidelines.

Since DVC provides diagnostic as well as positioning information, the valve status and response time can be monitored during the test.

Valve health performance is monitored and automatically analyzed after each partial-stroke test so that potentially failing valves can be identified long before they become unavailable.

The results of a signature test (See Fig. 1) can be used to easily determine packing problems (through friction data), leakage in the pressurized pneumatic path to the actuator, valve sticking, actuator spring rate, and bench set.

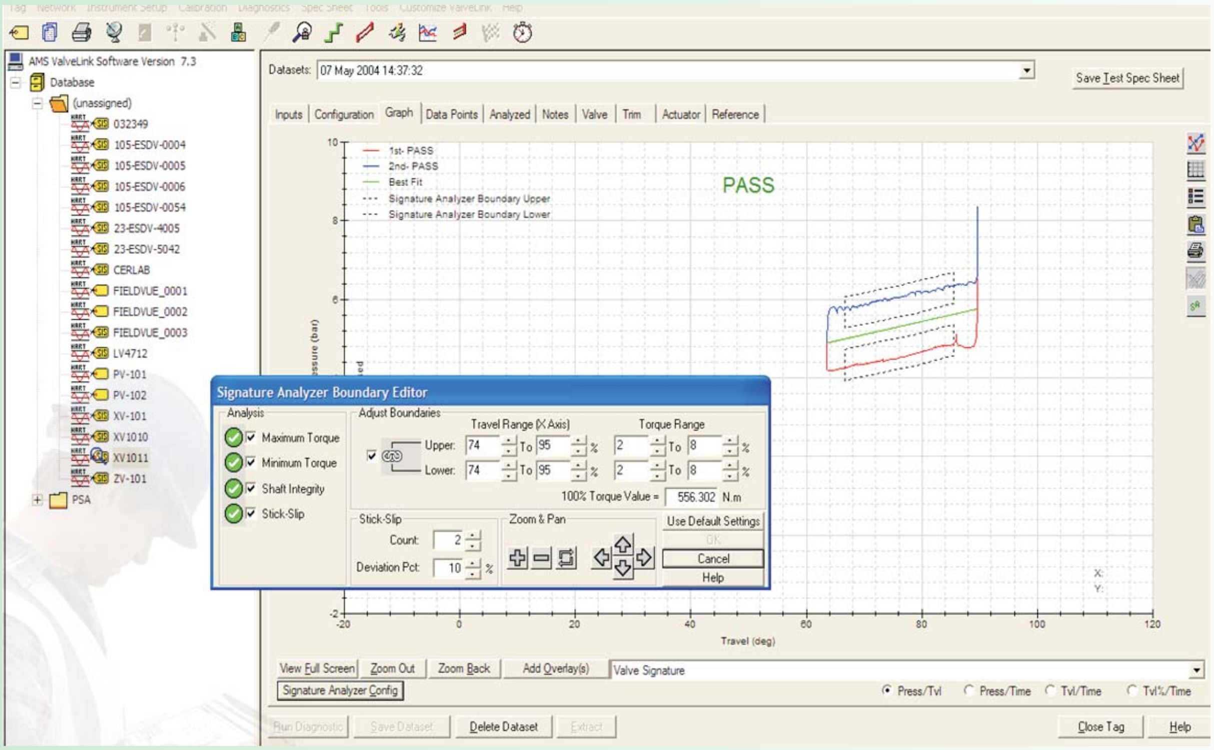

FIG. 1 – VALVE SIGNATURE TEST WITH ANALYSED TEST RESULTS

Should an emergency shutdown demand occur during testing, the Digital Valve Controller will override the test, driving the valve to its safe state.

DIGITAL VALVE INTEGRATION TO SIF

Digital Valve Controller can be added to any shut down valve style configuration, including linear sliding-stem, rotary, quarter-turn, etc. with spring and diaphragm actuators, spring-return piston actuators, or double-acting piston actuators.

Fig. 2 depicts a digital valve controller installed in a SIF loop, where Logic Solver provides and AO (Analogue Output) 0-20mA or 4 to 20 milliamp dc current signal to DVC. The signal is generated based on sensors and logic internal by the logic solver to DVC. Digital Valve Controller is used as safety and diagnostics device.

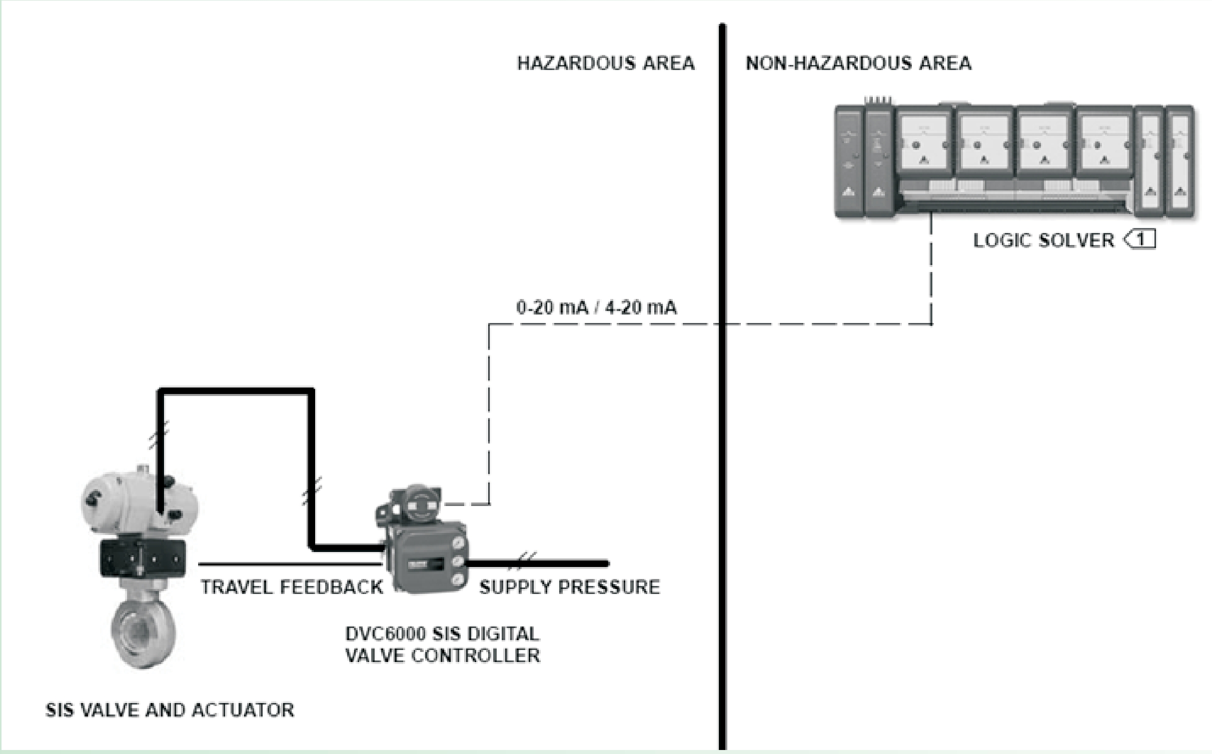

FIG. 2 – SIS SCHEMATIC WITH A DIGITAL VALVE CONTROLLER IN A SIF LOOP USING AO SIGNAL (4-20 mA)

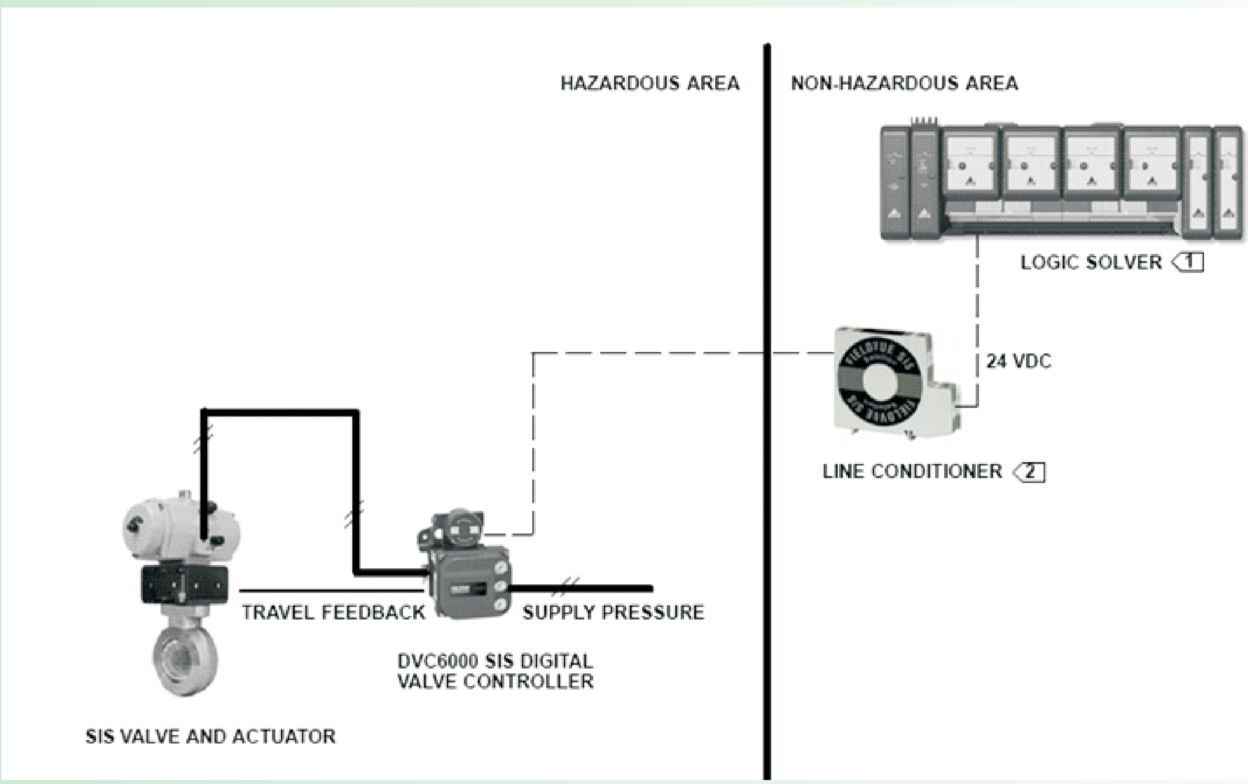

FIG. 3 – SIS SCHEMATIC WITH A DIGITAL VALVE CONTROLLER IN A SIF LOOP USING DO SIGNAL (0-24VDC)

Fig 3 shows a digital valve controller installed in SIF loop, where Logic Solver provides a DO (digital output), 0-24VDC to DVC. During normal operation, after the line conditioner, HART information is superimposed to get diagnostics information of valve health.

CONCLUSION

Digital Valve Controllers not only provide intelligence benefits in terms of performance and safety by allowing partial stroke test on line but also provides additional benefits in terms of ease, simplicity, flexibility diagnostics, improved reliability of SIF etc,.

By eliminating expensive conventional local test mechanism, which was laborious, time consuming and require specific talent, Digital Valve Controller reduces complexity and simplify the test process.

Digital Valve Controller predictive maintenance capability provides complete Final Element health analysis and reduces the amount of scheduled regular maintenance by extending turn around period.

Document audit is key requirements of functional safety standard IEC61511. Digital Valve controller provides a time and date stamp on all tests and reports, which is also very important for complying with the requirements of regulatory or statutory authorities.

One of the key advantages of Digital Valve Controller is to “Trigger” the Safety Event, and immediately log and start storing the complete event in the microprocessor.

In the end, Digital Valve Controller offers all unique benefits of microprocessor based device for shut down valves used in SIS application by providing on line diagnostics, recorded test results, remote accessibility, HOST integration and recoding the safety demand event. The use of a Digital Valve Controller for performing partial-stroke testing is a sensible and economically viable solution to ensuring the reliability of emergency shutdown safety systems.

---

[1] IEC61508 Functional Safety of electrical / electronic / programmable electronic safety - related system

[1] ISA- TR84.00.02-2002 – Part 2

[1] Offshore Reliability Data

NEW MEMBERS

Biju Thomas Padayaty
Kuwait National Petroleum Co
bijuthomas@eth.net

Ravi Raja
Kuwait National Petroleum Co
kro027@knpc.com