FOUNDATION™ Fieldbus Control Valve
“Device diagnostics”

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I. Prologue

Hey, Mr. Ashok, something wrong with CV Tag # LIC013. Maintenance is required immediately!
I. Prologue

Mr. Ashok - An experienced maintenance engineer

Our system operator tells me something wrong with this control valve but it is not so easy to find what is the nature of problem.

If it is clear from the beginning, my work can be much faster and easier... Is it just a dream?
I. Prologue

No, it is not a dream!

We can help you using Fieldbus technology.

OK, Mr. Ashok, we are pleased to explain how to do it but before let’s think together why control valve is so important?

Because control valve may give:-
- severe damages onto process.
- bad influences on production and safety of entire plant

➤ Control Valves are the HEART of the plant
II. Possibilities of CV failure

Control valve failure might occur due to:-

✓ Trim part leak
✓ Corrosion
✓ Stick by process
✓ Air leakage
✓ Actuator degradation
✓ Grand part degradation
✓ Others
III. CV diagnostics (Three phases)

Phase-1: Real time diagnoses (online)

Phase-2: Shutdown Maintenance (offline)

Phase-3: Maintenance plan based on historical data
III. CV diagnostics

Phase-1: Real time diagnoses

Detect “Zero Shift Alert” (POS_ALERT_LO)

Actual feedback position is +3% (shift) although Set Point goes below 0%
III. CV diagnostics
Phase-1: Real time diagnoses

Detect “Zero Shift Alert” (POS_ALERT_LO)

As a result of inspection, accumulated solid around plug and trim was found. Then the valve was cleaned up and safely re-installed to the process.
III. CV diagnostics
Phase-1: Real time diagnoses

Summary

• System operators realize some abnormal signals on control valves
• Serious issues should be solved immediately
• Minor issues can be recorded to do overhauling during the next shutdown maintenance
III. CV diagnostics
Phase-2:Shutdown Maintenance

**Standard diagnosis**

To check:-
1. Tightness of grand packing
2. Position according to air supply

Stroke between 10% and 90% to record relation between position and air supply as historical data

Automatically calculates spring range and friction

System Vendor: Yokogawa Electric
III. CV diagnostics
Phase-2: Shutdown Maintenance

Advanced Diagnoses

Various simulations:-

1. Travel vs. Actuator pressure
2. Travel & SP vs. Time
3. Actuator signature
4. Travel signature

1. Travel vs. Actuator Pressure
   Seating, Spring Range, Pressure

2. Travel & Set point vs. Time
   Overshoot, Resolution

3. Actuator Signature
   Friction, Spring Range, Pressure

4. Signature (travel vs. set point)
   Hysteresis, Dead band, Linearity

System Vender: Dresser Masoneilan

Automation 2010
III. CV Diagnostics
Phase-2: Shutdown Maintenance

Summary

✓ Compare data (valve signature, step response and etc.) with those previously collected so that daily maintenance can be planned efficiently.
III. CV Diagnostics

Phase-3: Maintenance plan based on historical data

A possible damage of bellows seal would be detected by Total_Stroke parameter. (TRAVEL_ACCUM)

This TOTAL_STROKE is as same as 40,000 times full open and full close.

System Vendor: Azbil (Yamatake)

Actual bellows seal after used

Replacement period

Automation 2010
III. CV Diagnostics

Phase-3: Maintenance plan based on historical data

Example (Chemical Plant-1)

Operation failure was found in stick-slip diagnostic function of control valve:

According to index of gland packing deterioration:
1. Detect abnormal sliding motion of plug guide
2. Detect plug bend, scratch & other mechanical damages
III. CV Diagnostics

Phase-3: Maintenance plan based on historical data

Example (Chemical plant-1)

- **Jun**
  - MV9019 (V100A)

- **Jul**
  - PV9002-2 (G20A)
  - PV9802 (B300A)
  - TV9005 (G65A)

- **Aug**
  - Stick-slip operation has started.
  - Stick-slip movement has been increased.

- **Sep**
  - Stick-slip movement has been increased.

- **Oct**
  - Stick-slip is not operated.
III. CV Diagnostics

Phase-3: Maintenance plan based on Historical data

Example (Chemical Plant-2)

Valve Travel Distribution support on Engineering & Maintenance

Confirm if the selected control valve size is appropriate or not by visualizing the stress index of inner valve on the condition of low travel operation.
III. CV Diagnostics

Phase-3: Maintenance plan based on historical data

Example (Chemical Plant-2)

Valve Travel Distribution support Engineering & Maintenance

Valve opening level is shifting from 20-30 % to 30-40% due to clogging of air filter or CV inner parts. End user can judge that it is the best timing for maintenance.
III. CV Diagnostics

Phase-3: Maintenance plan based on historical data

Example (Chemical Plant-3)

A possible damage of bellows seal would be detected by Total_Stroke parameter. (TRAVEL_ACCUM)

Sliding distance value could be applied as a reference value

High pressure Chlorine gas

Globe valve (Bellows seal type)

System Vender: Azbil (Yamatake)
III. CV Diagnostics (Three phases)

**Summary**

- Visualize various conditions of control valve through these analyses and historical data
- Plan CV maintenance efficiently according to present conditions of control valve.
IV. Conclusions

• Control valve diagnoses through Fieldbus are valuable. Fieldbus suits for **real time notice** since the data transmitting speed is much faster.

• **Offline maintenance** with various simulations is useful on data comparison with those collected in the past.

• **Condition based maintenance**, it is important to analyze historical data collected through valve positioner. Fieldbus is highly recommended collecting various data on control valve.
V. Progress beyond conclusions

a.) Device diagnostics

• Fieldbus Foundation has ever solved users’ requirements to define “Standard Diagnostic Profile” and “Standard Transducer Block”.

• Fieldbus Foundation wishes end users to try and evaluate fieldbus diagnoses more in order to improve functions on the basis of user-friendliness and interoperability.

Enhancement of device diagnostics for end users
V. Progress beyond conclusions

b.) Fieldbus Foundation works with NAMUR (FF912)

Using the power of FOUNDATION Fieldbus, and considering NAMUR requirements, the new standard diagnostic profile aim to:

- Standardize the integration of diagnostic information
- Guarantee valuable information to the user
NE107: “Self-Monitoring and Diagnosis of Field Devices”

- Diagnosis results must be reliable
- The diagnosis results must always be viewed in the context of the application.
- Internal diagnosis categorized into 4 standard status signals
- Configuration should be free, as reactions to a fault in the device may be very different depending on the user's requirements
- The plant operator to see only these status signals
- Detailed information can be read out by the device specialist
V. Progress beyond conclusions
d.) Device diagnostic alarms (NE107) scope

Device Diagnostics Support Function
• Device status
• Diagnostics to host system

Communications Diagnostics

Control System

Fieldbus Foundation
Freedom to Choose. Power to Integrate.

FF Device Status

Asset Management

Device Management

Field Performance Diagnostics

Plant Diagnostics

Step 4

process and equipment

Step 3

actuators, elements
valves, connections

Step 2

Step 1

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Thank you for your attention!!

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