Wireless Valve Position Monitoring, Diagnostics and Predictive Maintenance through ISA100

ISA100 End Users Conference / Rotterdam
27 September 2016
Presented by Israel Radomsky

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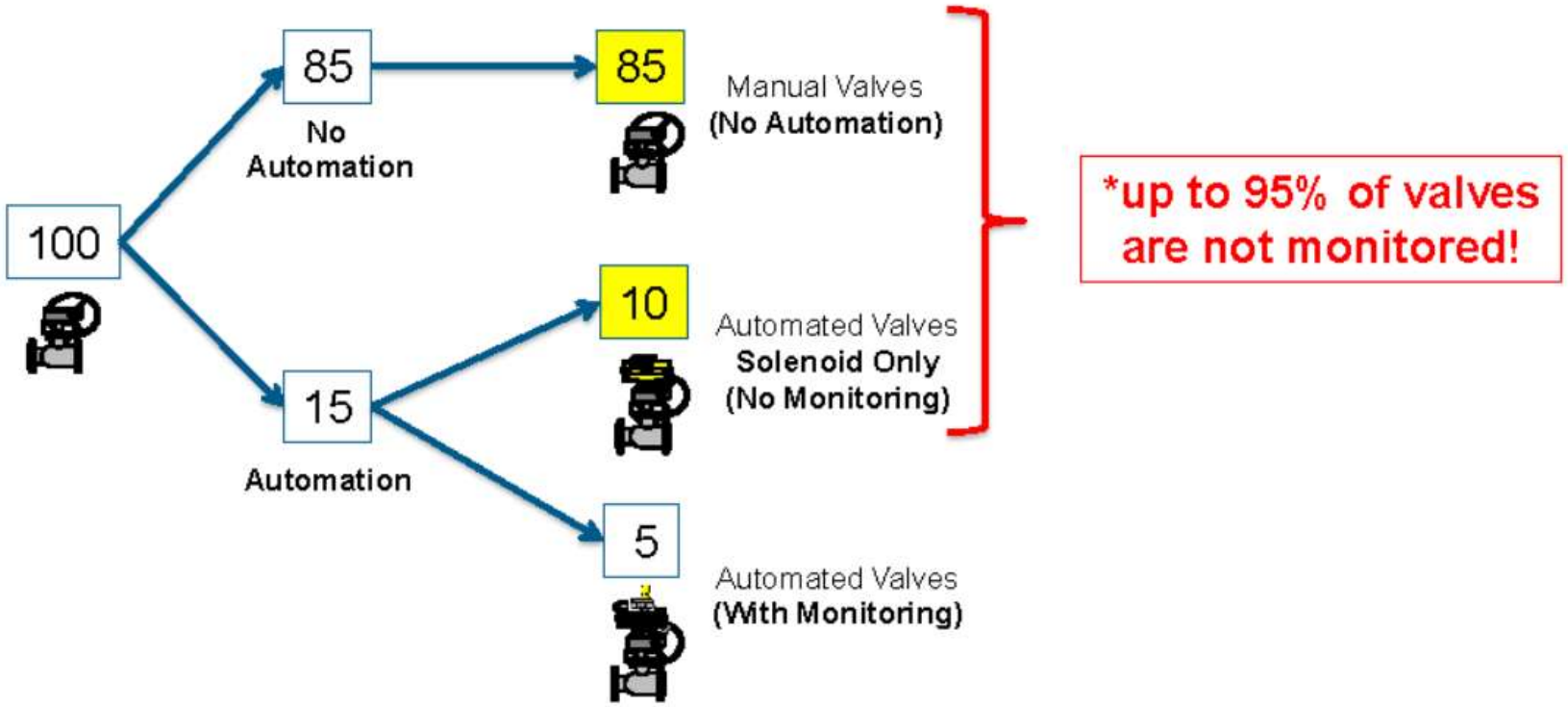
Typical Industrial Application of Valves



Main reason is cost: data suggests **$2K to $5K per valve**
(Wires, Cable Trays, Cabinets, I/Os, Installation…)

**Ratio may vary depending on process and application*

Valve Monitoring – Current Situation

- There is a real need for valve monitoring in the process industry.
- Valve malfunctioning can result in :
  - Danger to human and compromise safety
  - Affect yield
  - Generate environmental risk
- In some industries regulation requires valve monitoring
- The current solution – wired Switch Boxes:
  - Costly to install in the process industry
  - Cost increases due to explosive environment
  - Source for failures due to harsh environment

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The Cost of Wired Solution

- Various Field Buses have not changed the situation
- The Switch Boxes are still connected via wires to bus concentrators.
- Wires must be laid, protected, brought to concentrators and connection tested to the I/O.
- Deploying wires can cost $100 to $400 per meter, making the cost of a wired monitored valve prohibitive at $3,000 to $12,000 (assuming 30 m home run cable per valve).

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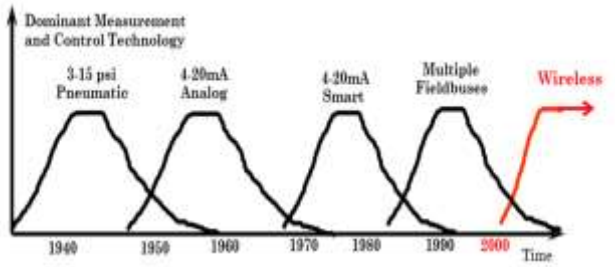
WIRELESS INSTRUMENTATION IN OIL & GAS INDUSTRY - Financial Drivers



Greenfield Sites (new facilities)

- By using typical vendor prices, and cost estimates on work load and hours from former Statoil projects, the **total cost saving per wireless instrument is approximately USD 3,300**. Note that the cost saving per instrument will increase with an increased number of wireless sensors per gateway, and vice versa.

Brownfield Sites (existing facilities)

- For typical monitoring instruments (pressure, temperature, etc), **cost savings are estimated to 2-3 times higher compared to Greenfield projects** with remote I/O, i.e. **in the area of USD 6,600 to USD 9,900**.

Source: Petersen, S. and Carlsen, S., "Wireless Instrumentation in the Oil & Gas Industry - From Monitoring to Control and Safety Applications", SPE Intelligent Energy International 2012, Utrecht, The Netherlands, March 27-29, 2012,

Process Industry Valves Operation Challenges

90% of Valves in the process industries are not monitored due to high TCO costs

Process Failure

1. **Reduced yield**
2. **Prone for human errors**
3. **Health, Safety and Environmental events**
4. **Inferior or expensive maintenance strategies**
5. **Compliancy with emerging regulations**

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What End User Expect from Valve Monitoring

- Accurate and repeatable position indication
- Real time response time (less than 1 second)
- Small size sensor
- Ease of installation
- Any valve any where (manual, actuated, small, big, 1/4 turn and linear)
- Dynamics analysis of pneumatic actuators
- Actuated valves diagnostics
- Low cost
- International Standard compatible

ISA100 Valve Monitoring and Diagnostics

- ISA100 based valve monitoring can fulfils these requirements:
  - Accurate and repeatable
  - Near Real Time response
  - Small size
  - Ease of installation
  - Any valve
  - Valve diagnostics
  - Low cost

VD ISA100 Free Space Test

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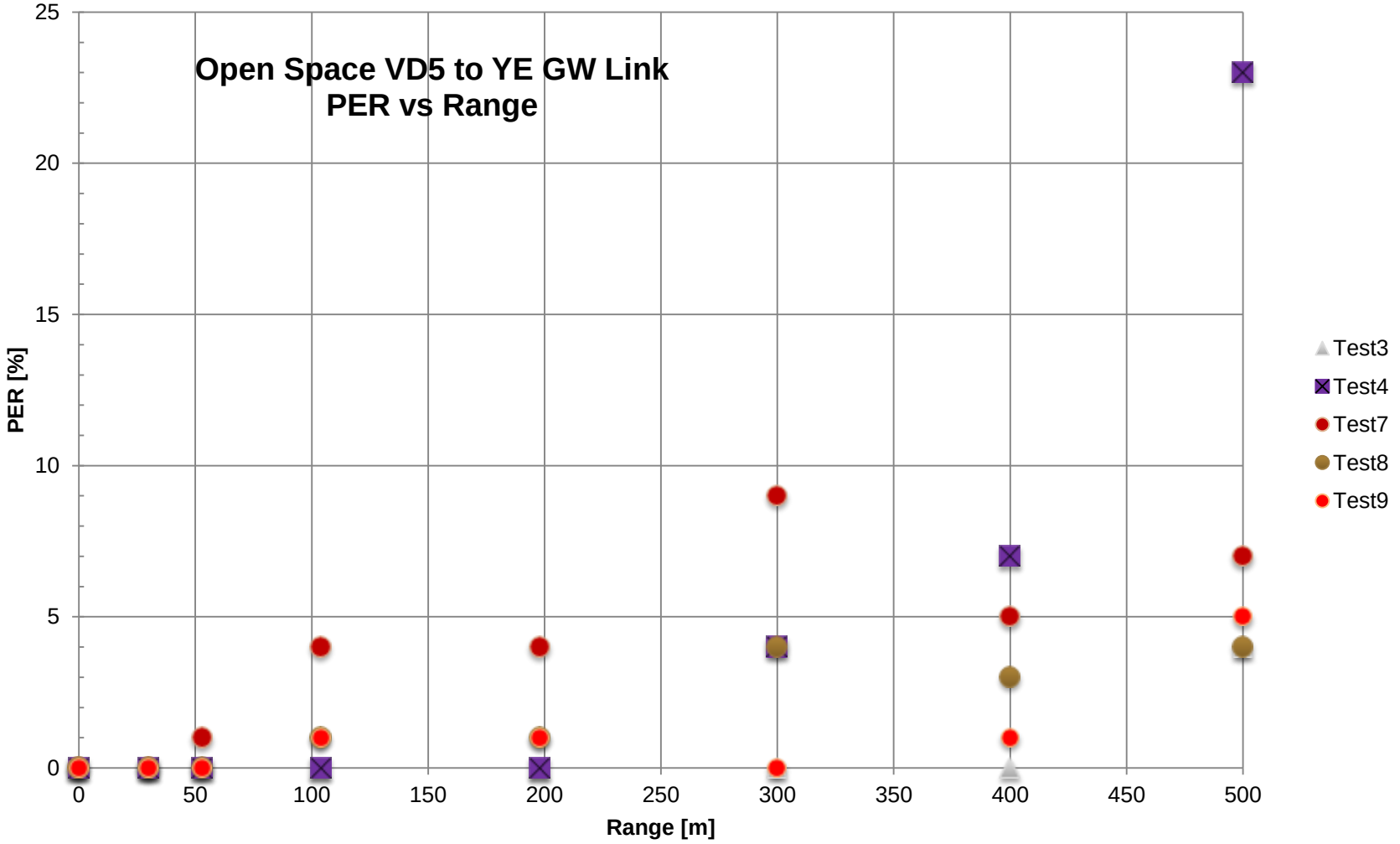
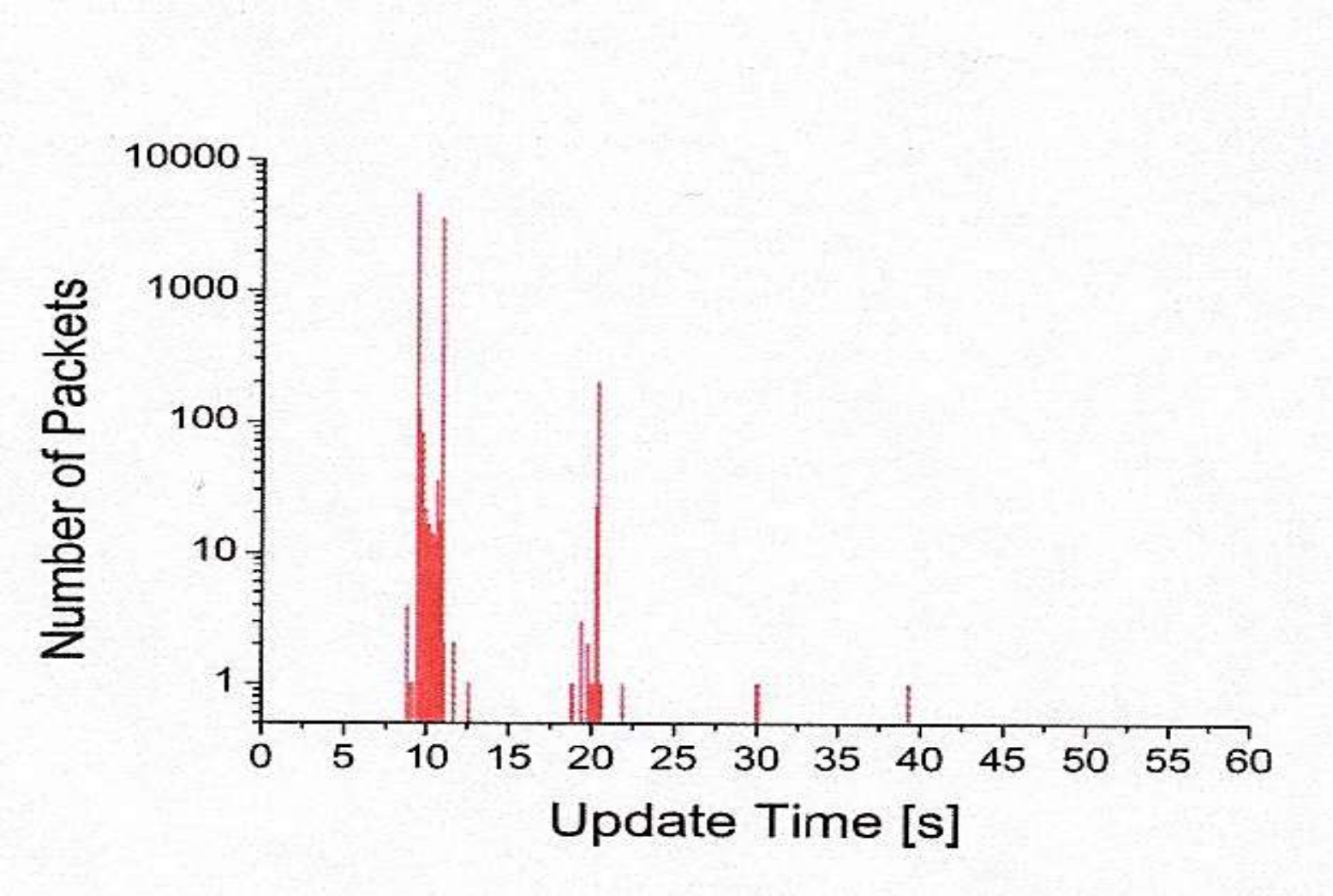
VD ISA Free Space Results



Ifak (Germany) Lab Test Report

- Ifak is an independent lab in Germany focused on evaluating various wireless technologies.
- In 2010 ifak performed an evaluation of WirlessHART performance.
- The test results were presented at the Automation exhibition in Hannover in April 2010.
- The ifak presented performance data is similar to WH vendor data.

WirelessHART – Update Time



Source: Ifak Lab Test Comparison (April 2010)

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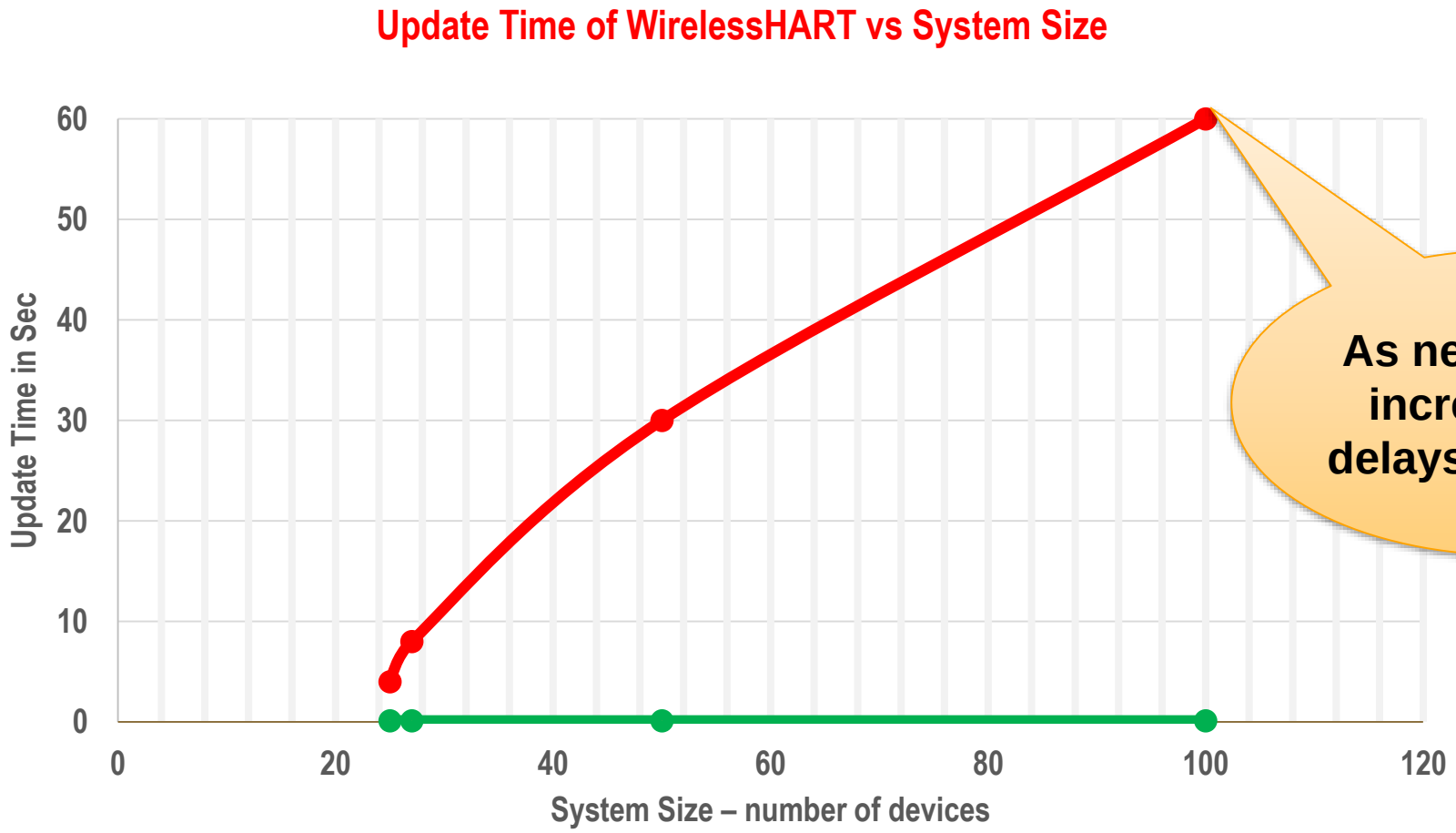
Wireless HART UPDATE Time



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Valves Monitoring & Diagnostics

Field Experience

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The Eltav Company

- Company stage – sales and implementation
- Development, production, sales and support of wireless valve monitoring and diagnostics solutions
- Products with ISA100 and ZigBee Protocols.
- Member of ISA100 standard committee since 2006.
- ZigBee in production; ISA100 scheduled industrial release end 2016.
- ISA100 product in collaboration with major System Company.
- Located in Ranana Israel
- Founded in 2006.
- Acquired by Rotork in November 2015.

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The Wireless Valve Monitoring Device (VD)

- Autonomous, Power Efficient
- Retains configuration
- LEDs for alive indication
- Installed on a Valve or an Actuator
- Measures Angle, Temperature, Dynamics, Battery, (4 Digitals)
- ISA100 or ZigBee,125KHz Magnetic and IR OOB provisioning
- In future – control of valves.

Wireless monitoring is here!

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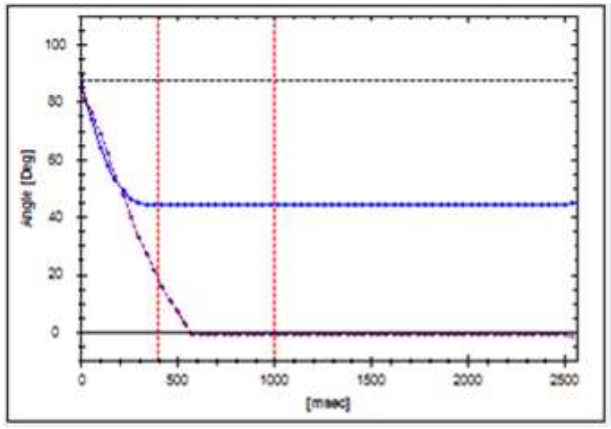
SOLUTION DESCRIPTION

Eltav offers a breakthrough wireless technology, that provides real time information directly to control systems.

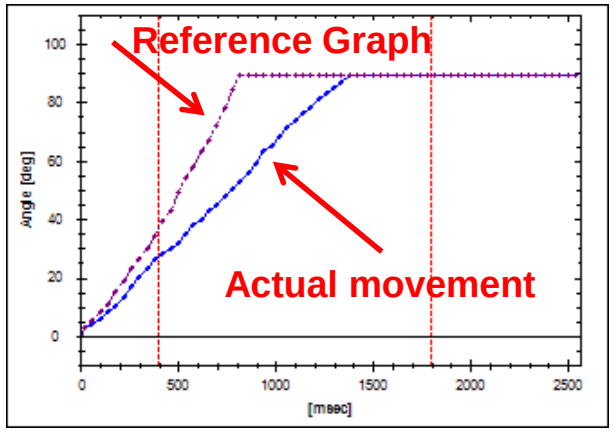
- **Full Range Position- 0%-100% (Detecting the un completed movements)**
- **Predictive Valve Maintenance (Detecting damaged O-Ring, air pressure problems, sticky valve, hydraulic shock etc.)**
- **Any valve, Any Actuator (quarter turn, multi turn, Gate valves, Diaphragm valves, etc.)**

VD ISA100 Diagnostics Features

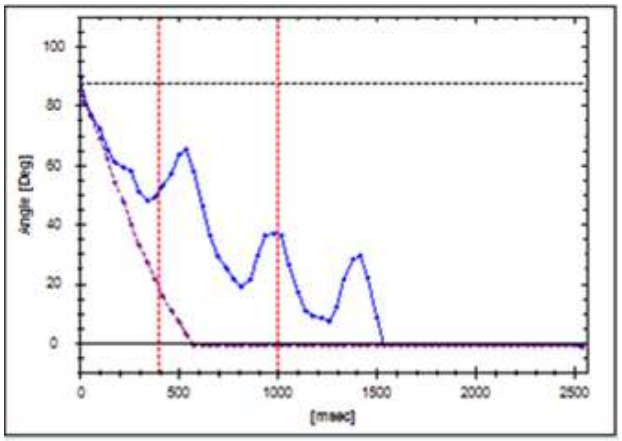
Partial open



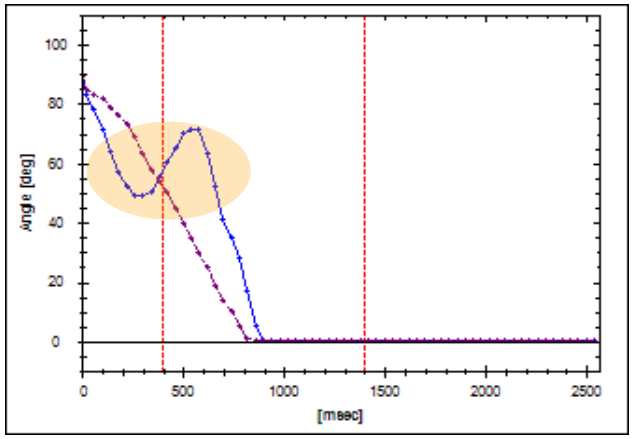
Prolonged movement



Air pressure problem



Sticky valve



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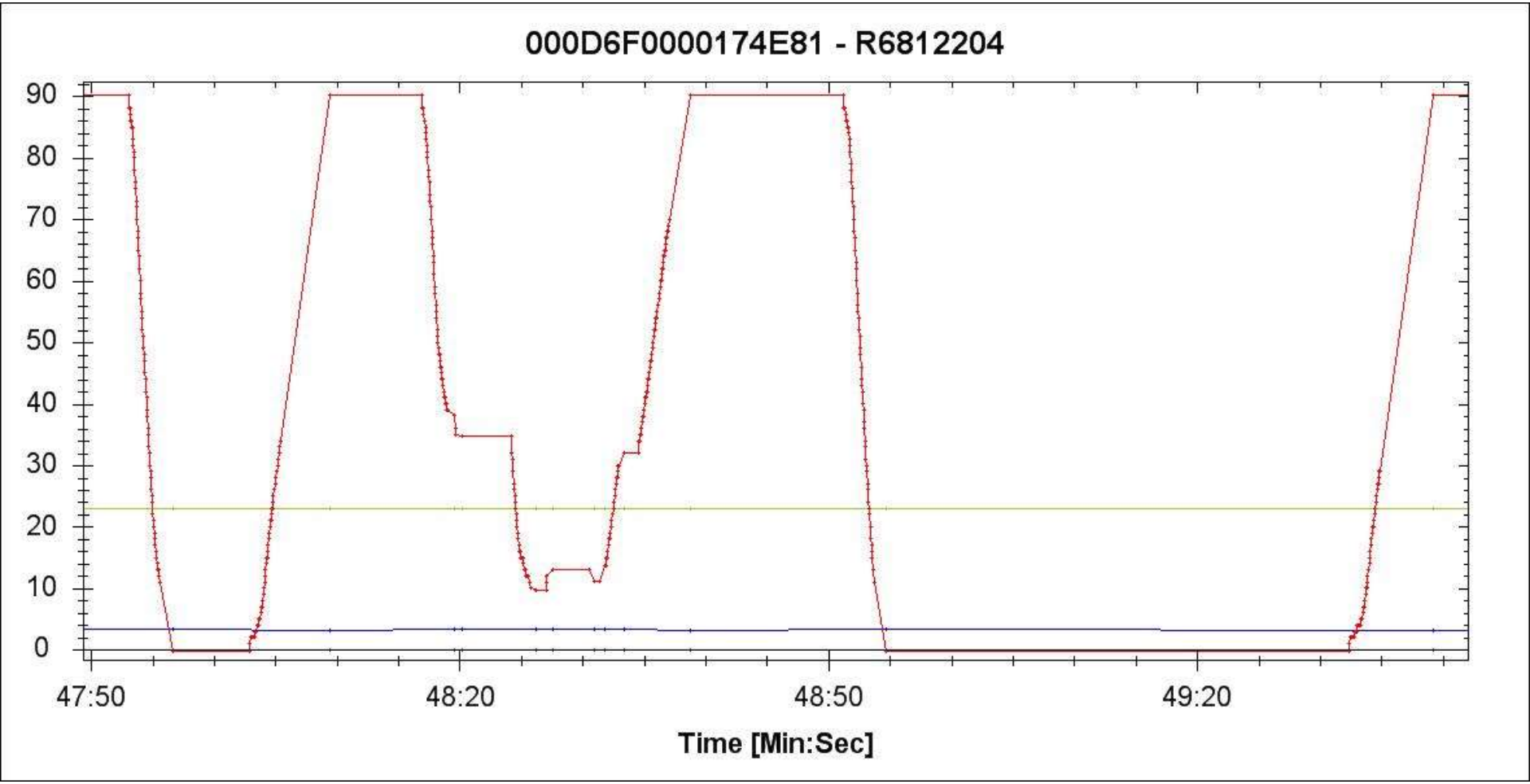
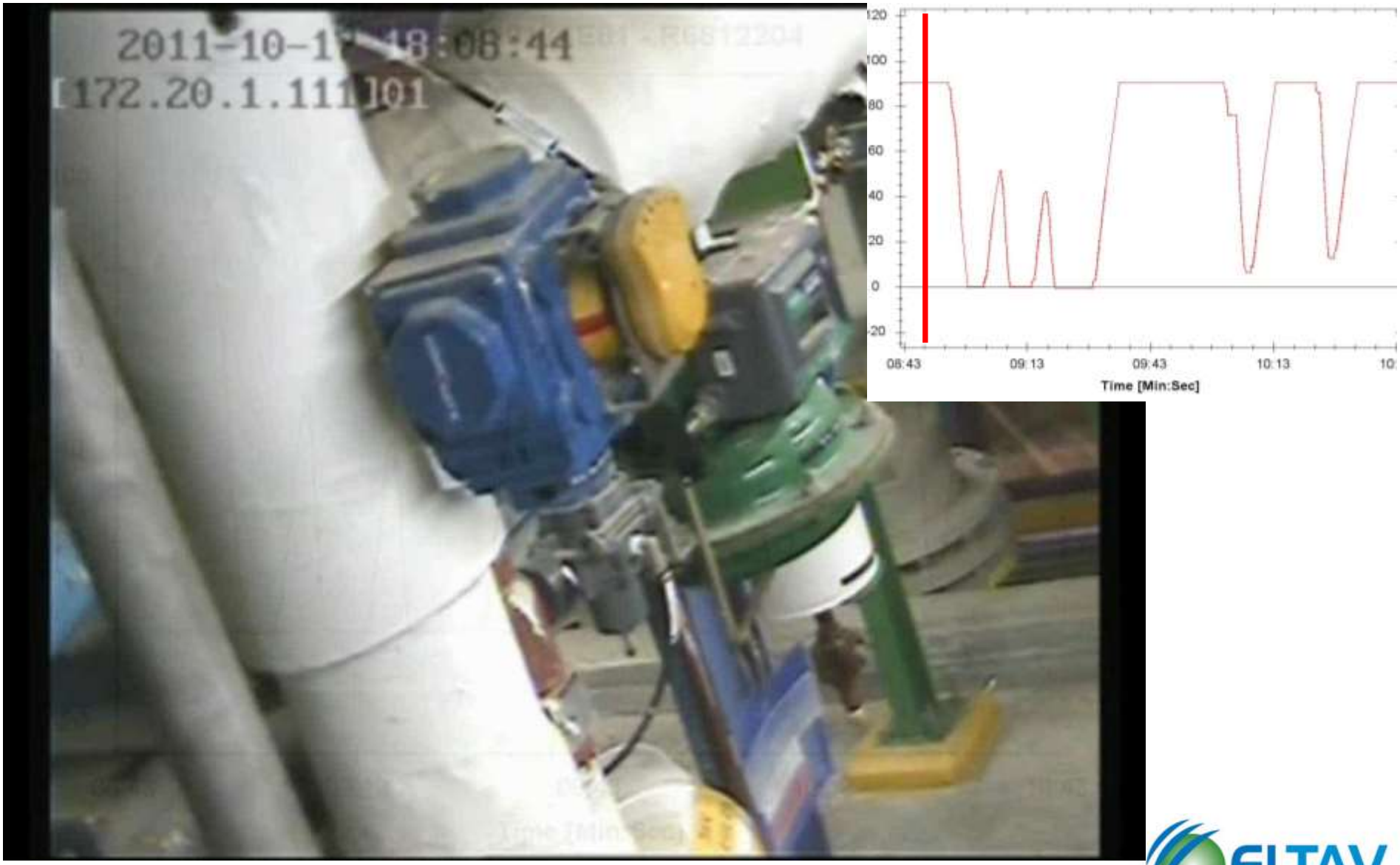
Malefunction of Actuated Valve



Teva Tech

FIELD EXAMPLE – LIVE DIAGNOSTICS MOVIE



Keeping the World Flowing

ANY VALVE ANY ACTUATOR

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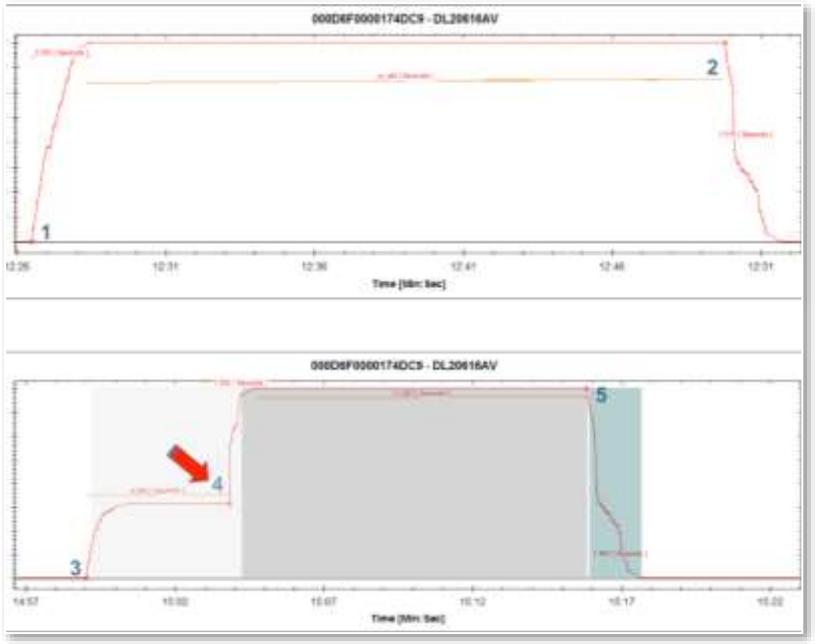
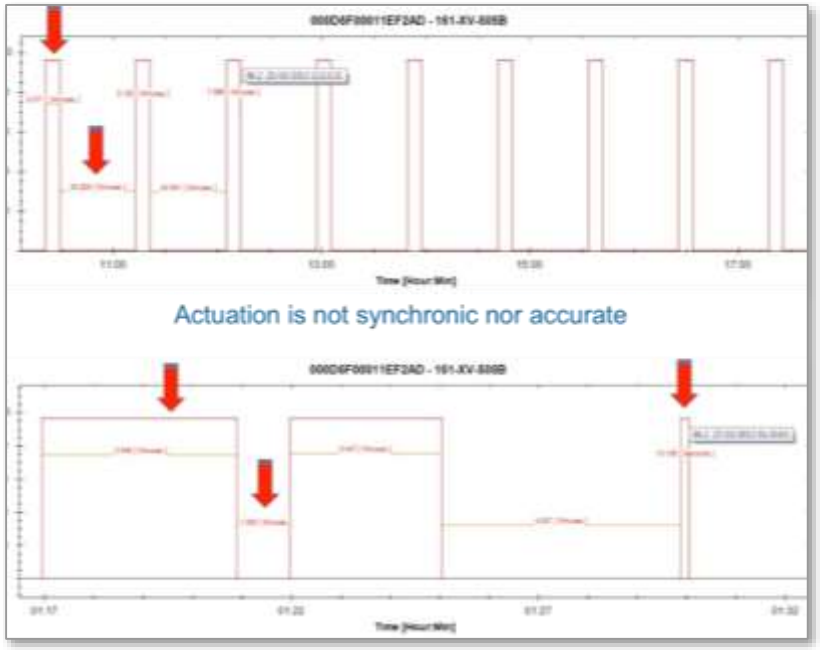
ANY VALVE ANY ACTUATOR – Cont.

DYNAMICS – CONTRIBUTION TO THE END USER

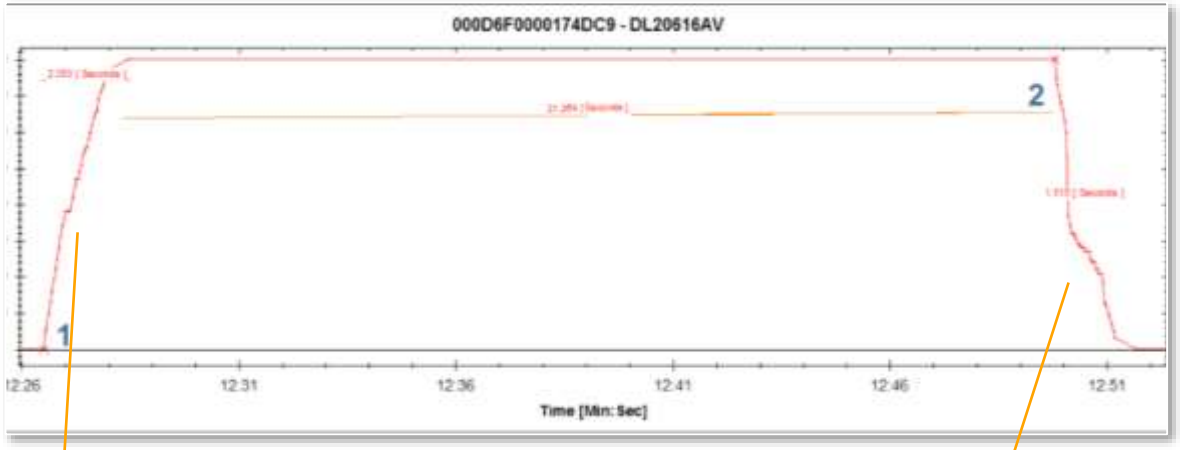


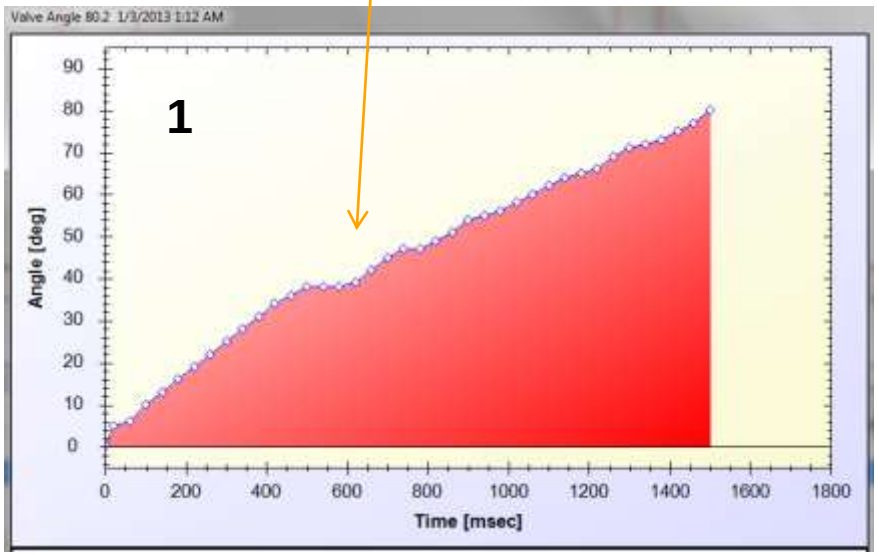
Irregular operation of the valve/actuator

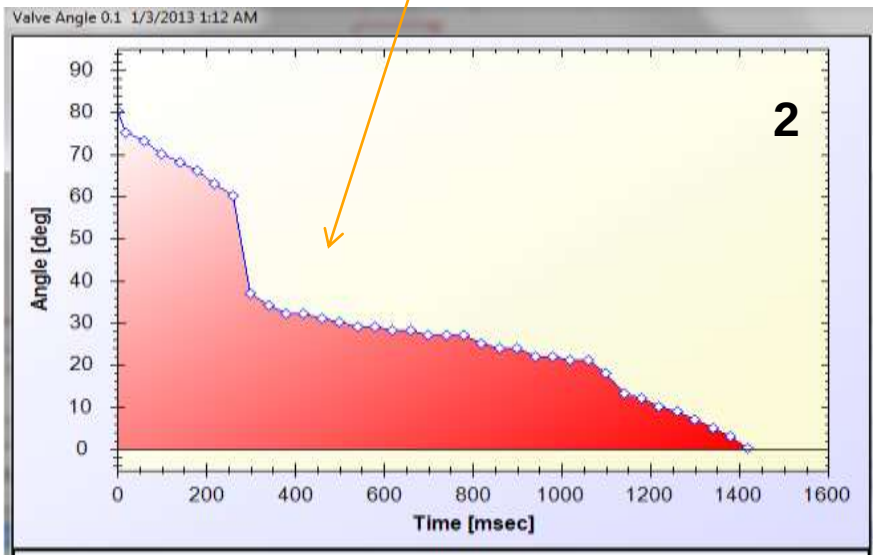


Process lack of synchronization

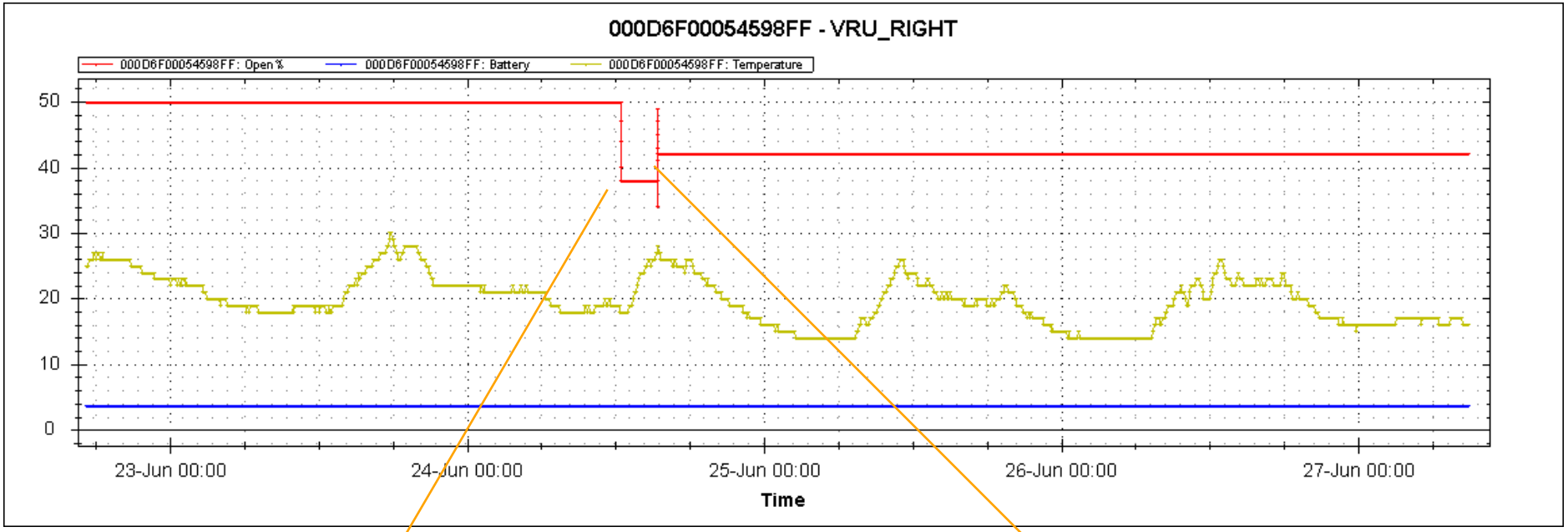
DYNAMICS – MEASUREMENT IN MSEC RESOLUTION

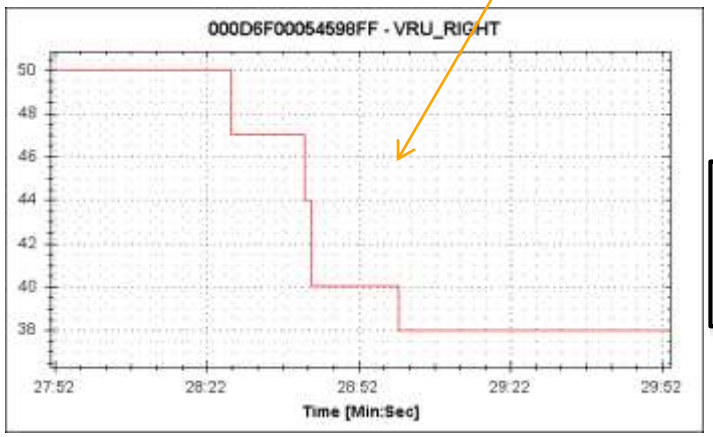




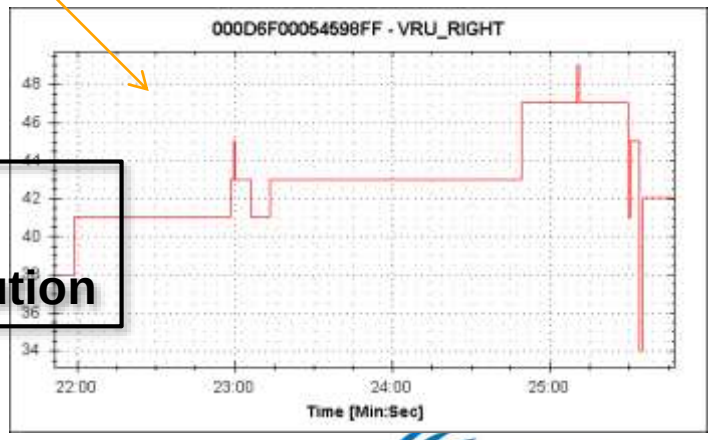


FULL INTERNAL LOGGING SYSTEM





Logging system in milliseconds resolution



Vopak - Rising Handle

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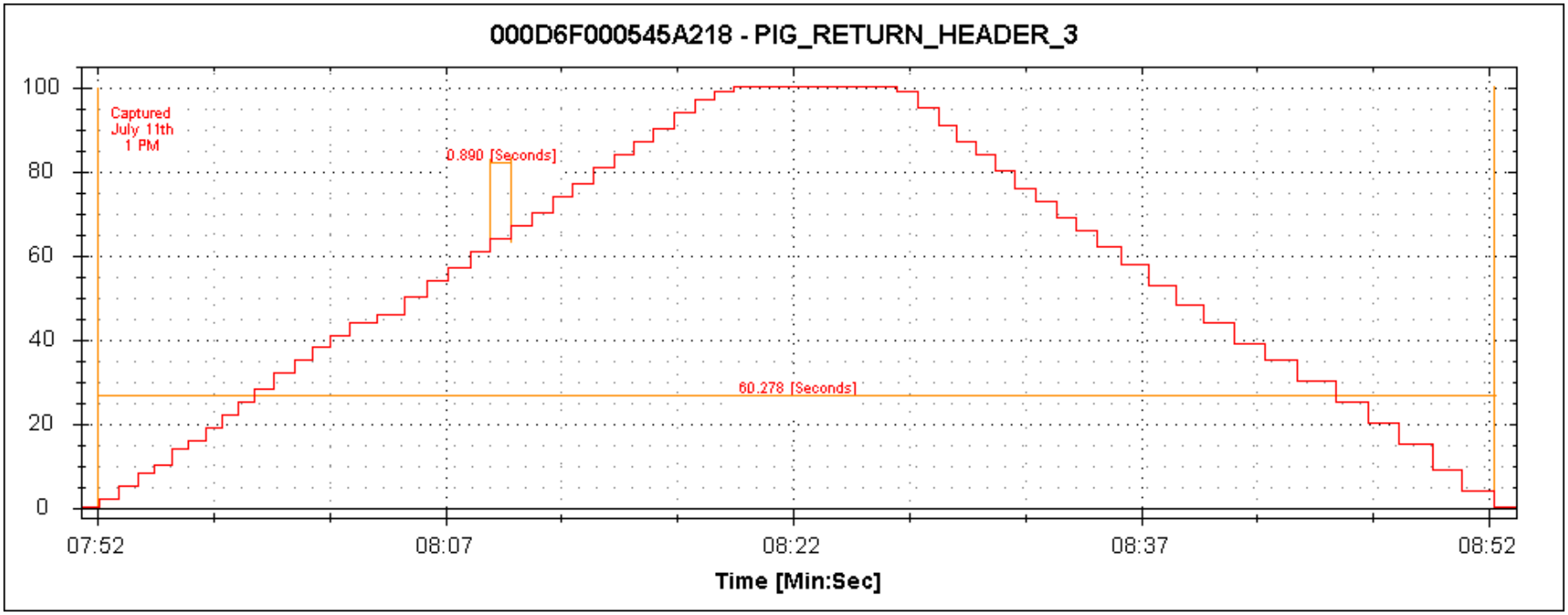
Raising Handle 2.wmv

REAL TIME POSITION MONITORING

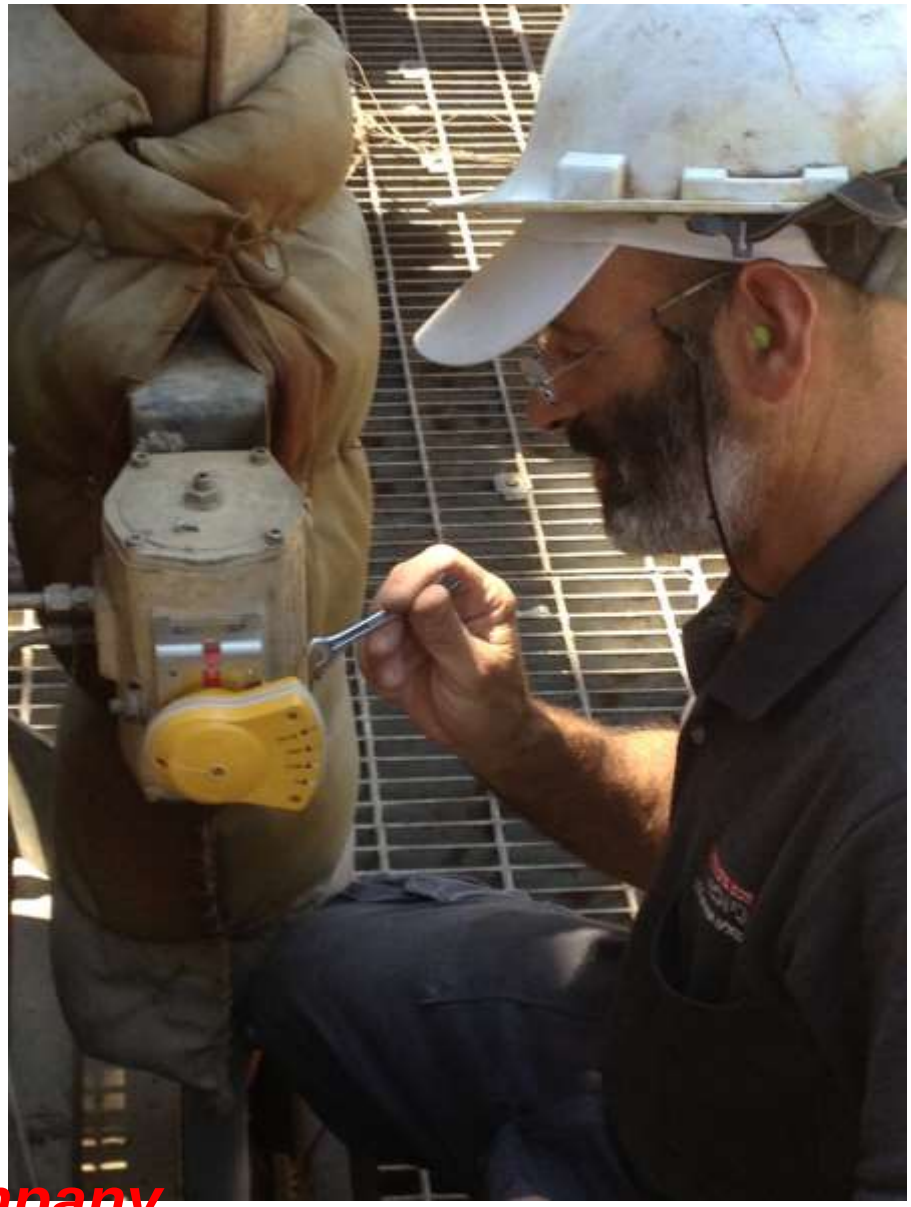
Monitoring of true valve position (0-100%) in real time



To reduce the risk for unwanted fluid release and cross contamination a monitoring solution is desired for Vopak globally to determine the position of valves at real time

Paz Refinery in Israel

Paz Refinery – VD Installation



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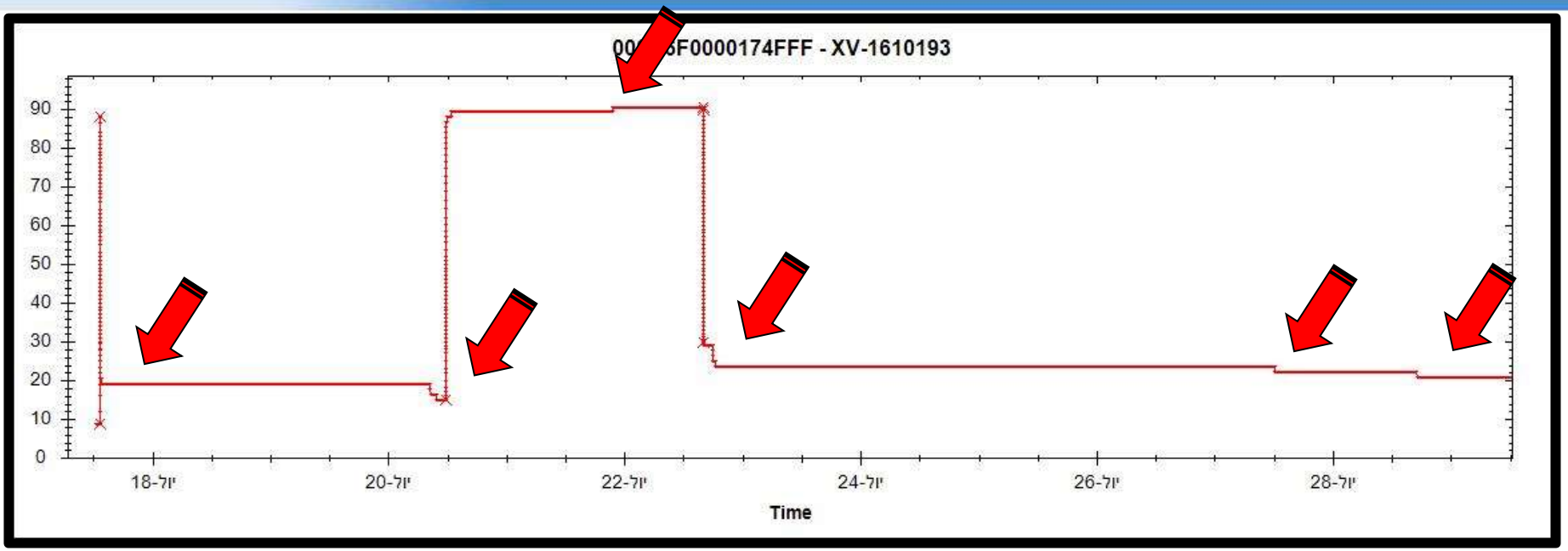
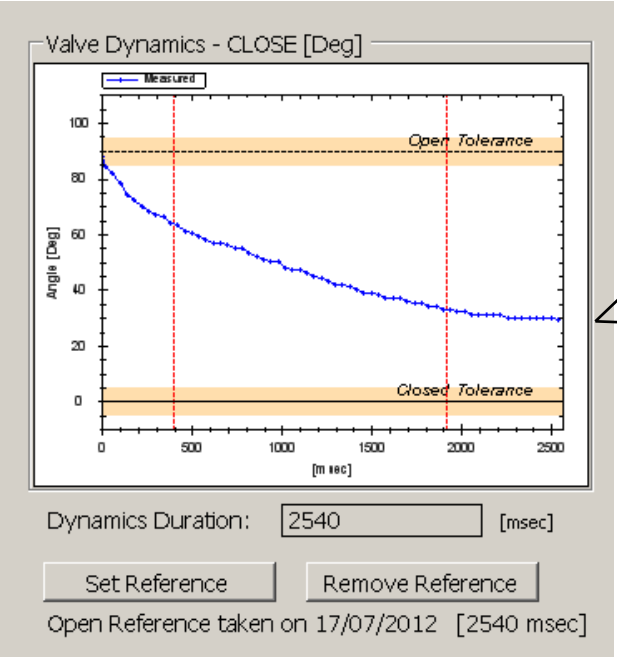
Field Example- Detect the un completed valve movement



VALVE STATUS SUMMARY

EUI	Valve Tag	Last Seen	Hardware Timestamp	Angle	Open Percentage	Valve State
000D6F0000174D6F	XV-1610171	12:36:03.203,א ום'	12:36:03.147,א ום'	92.3	100	OPEN
000D6F00001750AF	XV-1610177	12:36:33.078,א ום'	12:36:33.011,א ום'	0.5	0	CLOSED
000D6F0000174C00	XV-1610178	12:37:12.578,א ום'	12:37:12.536,א ום'	-0.2	0	CLOSED
000D6F0000174FFF	XV-1610193	12:35:36.468,א ום'	12:35:36.406,א ום'	19.2	18	PARTIALLY
000D6F0000174CF2	XV-1610200	12:35:50.890,א ום'	12:35:50.850,א ום'	-0.2	0	CLOSED
000D6F0000174CF1	XV-1610175	12:35:12.875,א ום'	12:35:12.700,א ום'	0.0	0	CLOSED



Position Status
19.2°

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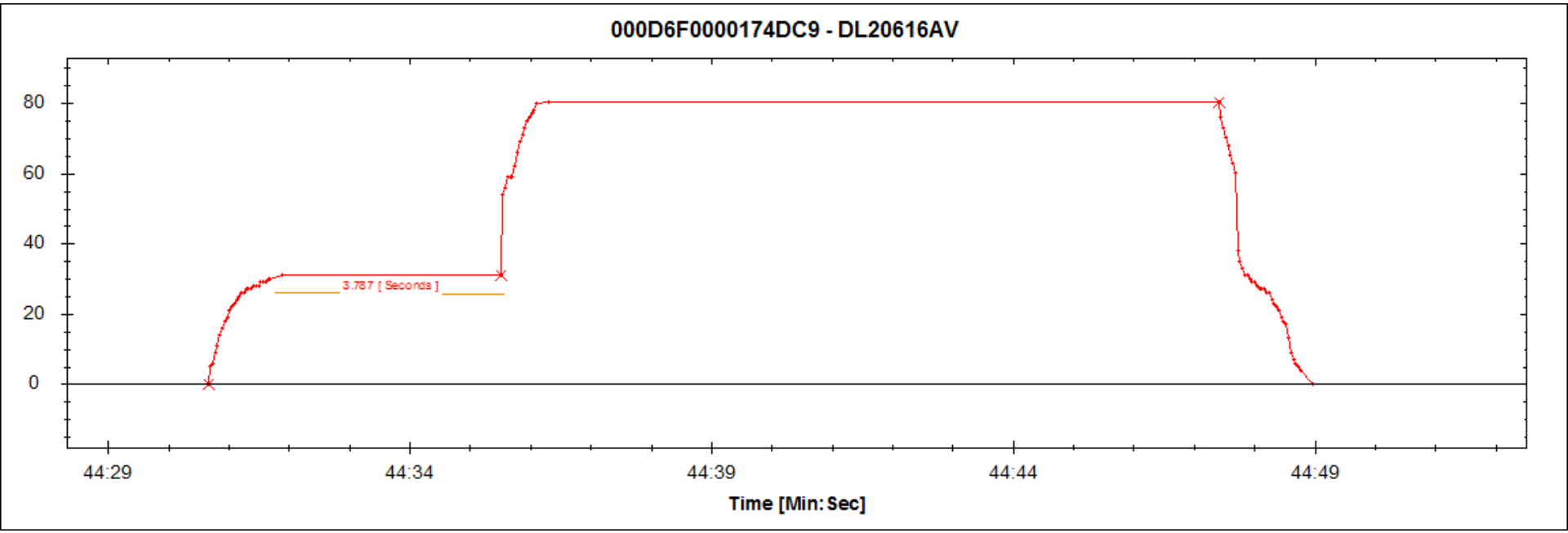
Detect the Mid Short Stop of Valve Movement



Mekorot Eshkol

Filtration site of National Water Co.

The Challenge:

- Monitoring the process of adding chemicals to drinking water

Mekorot Eshkol

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Sapir – Sea of Galilee Intake

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Rotem - Flap Position Measurement

Rotem 20120227_121223.mp4

Kemira – Specialty Chemicals

Chemical Production site

The Challenge

Monitoring critical manual valves in the process following an incident

The Solution

The Eltav wireless solution has been installed on variety of manual ball valves and actuators providing process interlocks and on line monitoring.

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Chemical Industry

Kemira Typical Manual Valve Installation

Dannon Installation - GEA Valve

Dannon Installation

Lifting Monitoring

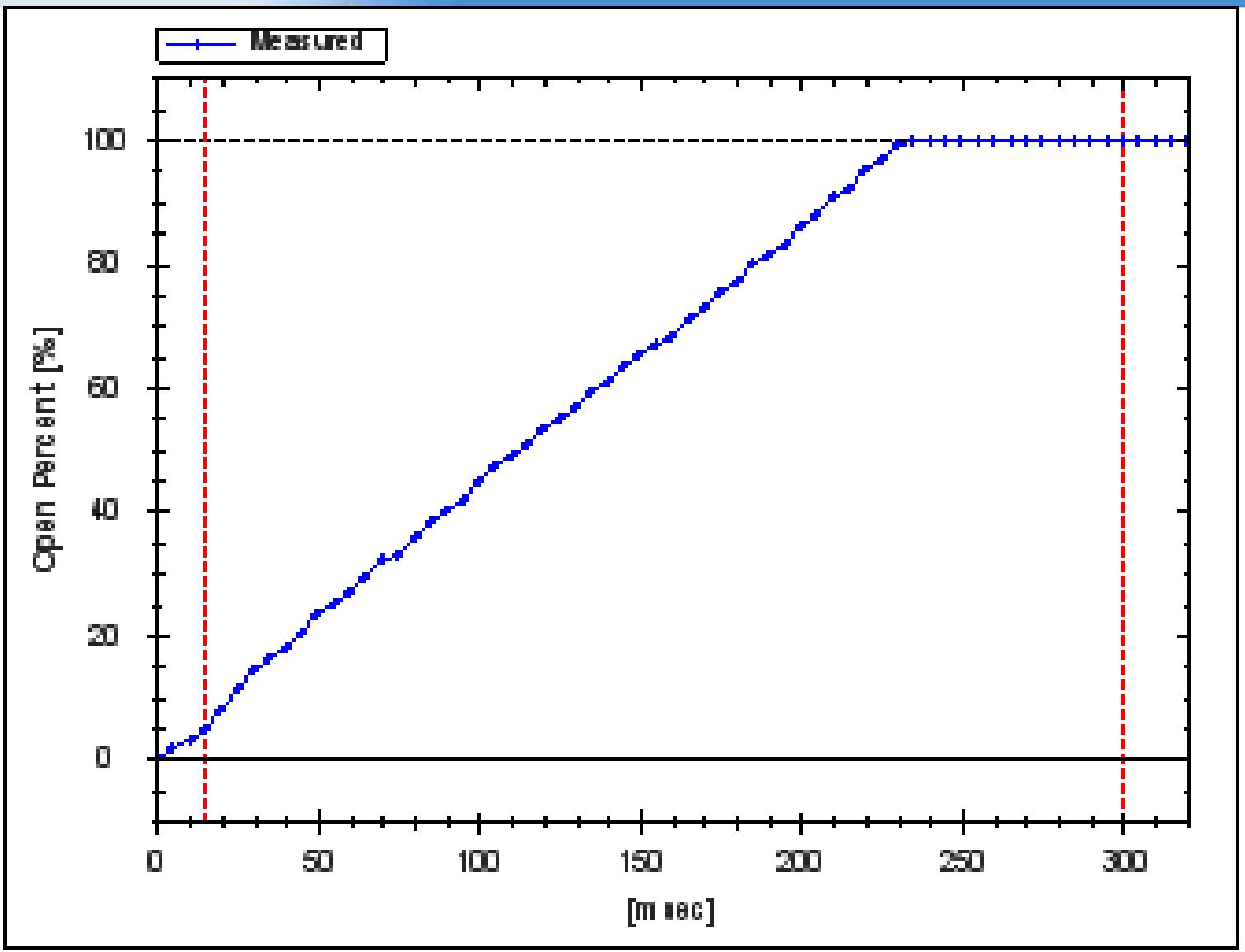
ON OFF P1080011.MOV

Lifting P1080012.MOV

ON OFF Lifting DEMO P1080136.MOV

GEA in Field Strauss P1070500.MOV

Dynamics CLOSED > OPEN



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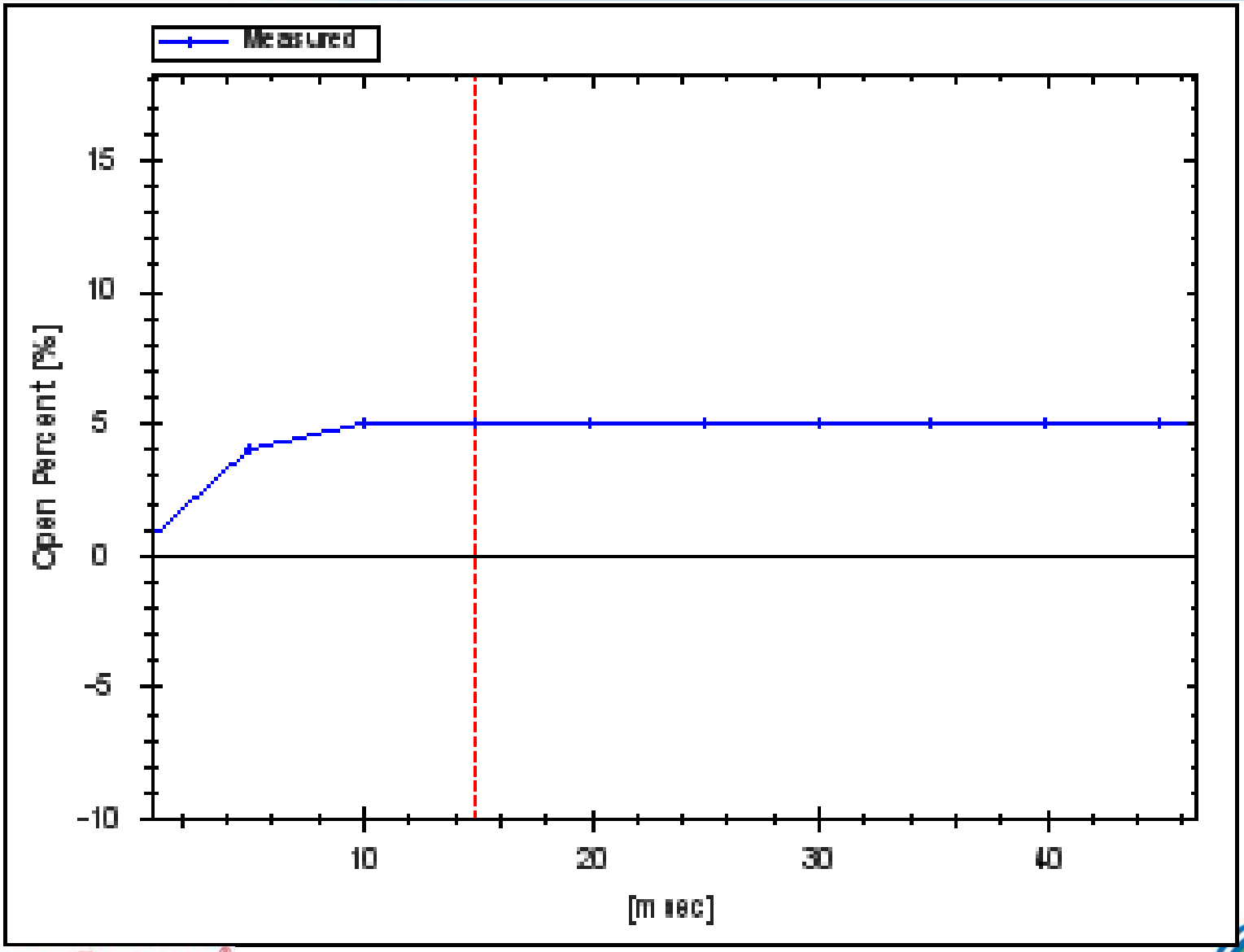
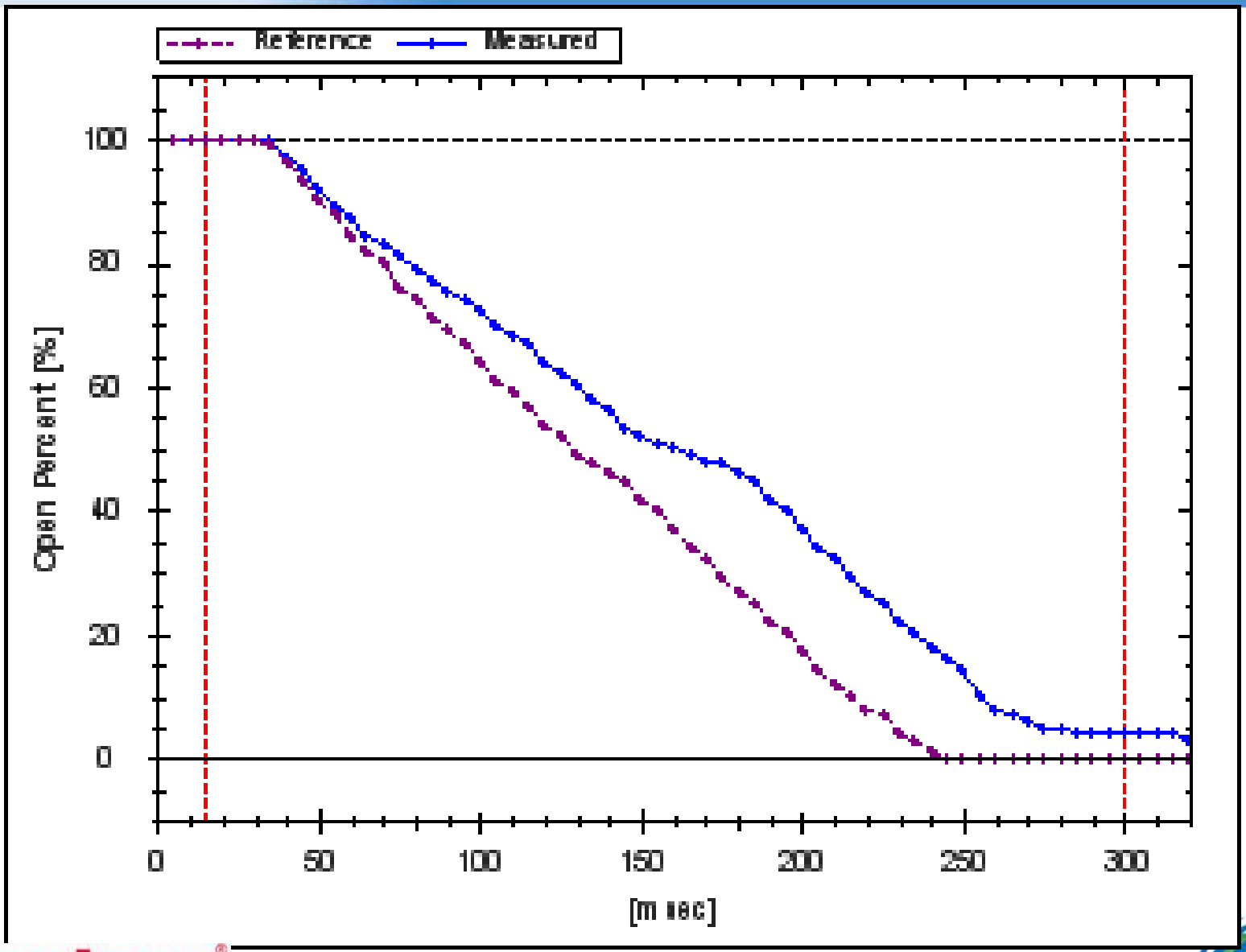
UP LIFTING on OPEN/CLOSED AXIS ENLARGED



George Fisher Torn Diaphragm Detection

Test #	Torn Diaphragm	New Diaphragm VD Calibrated (REF) Figure of Merit
1	50.6	5.0
2	95.1	7.4
3	42.8	0.1
4	101.2	1.9
5	52.6	0.1
6	74.2	0.6
7	41.0	0.1
8	69.4	1.0
9	53.2	0.1
10	83.5	2.0
11	54.1	0.1
12	72.2	0.3
13	44.5	0.6
14	75.7	2.8
15	35.8	0.4
16	60.6	2.0
17	43.7	0.2
18	50.6	1.1
19	39.1	0.1
20		1.9
21		0.8
Average	60.0	1.4

Damaged O-RING



Thank You

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