EMERSON EXCHANGE 2025

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1-1887 - Harness the Power of Advanced Diagnostics to Gain More Insight into Your Process

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Emerson Diagnostic Overview

Achieve Better Results with Advanced Diagnostics

Reduce Maintenance Costs

Focus on devices that actually need maintenance

Improve Product Quality

Identify process optimization opportunities

Increase Process Uptime

Prevent abnormal process conditions before they occur

Increase Throughput

Run closer to set points

Reduce Waste & Rework

Prevent process upsets that impact product quality

While terms may be similar. . .

Each diagnostic package will be unique to its specific technology

Modern Processes Challenges Require Innovative Solutions

- **Reduced Headcount** | Adversely affecting teams' ability to meet targets, impeding their efficiency and effectiveness

- **Reduced CAPEX/OPEX** | Limited budget means that measurement teams must get more done using the equipment they have

- **Knowledge Gap** | Significant losses of experience and expertise from retirement

Emerson's Advanced Diagnostic Solutions Tailored to Fit the Needs of Your Process

PREVENTION

- Early alerts allow you to identify problems before they happen
- Give less experienced technicians the insight to make expert-level decisions

CONFIDENCE

- Redundant system for validating meter performance
- Supplement lost operational knowledge with advanced diagnostics
- Automatically execute compliance workflows

RESPONSE

- Troubleshoot and diagnose process and meter issues in a fraction of the time
- Remote monitoring and inspection to free up front-line teams

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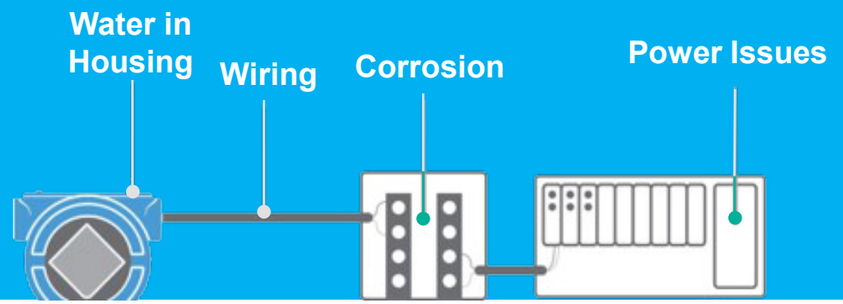
Pressure

Rosemount™ Pressure Advanced Diagnostics Provide Coverage From The Process To The Control Room

Loop Integrity

Detect Electrical Loop Issues that Cause On-Scale Failures



Transmitter Health

Comprehensive Transmitter & Safety Certified Diagnostics

- Enhanced Safety and Device Logs
- Guided Proof Test with Logging
- Improve Visibility to Your Operation with Expanded Process Alerts

Time Since	Event Name
01 yr 003 days 02:14:53	Incompatible Sensor Module - Alert Active
01 yr 004 days 03:12:12	Pressure Out of Limits - Alert Cleared
02 yr 003 days 09:14:12	Log Cleared

Process Intelligence

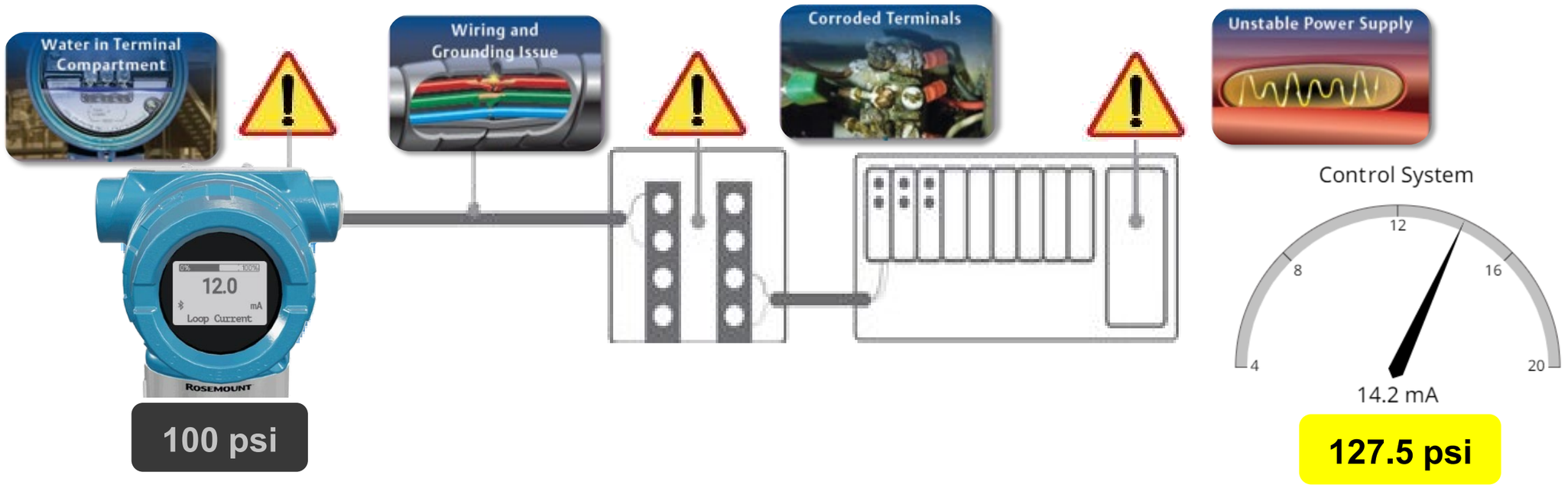
Spot and Diagnose Process Problems Before Issues Occur

- Plugged Impulse Lines
- Process Changes
- Process Transients

Loop Integrity Diagnostic Performs a Continuous Loop Test

Challenge:

- Multiple issues can lead to degradation of the electrical loop causing an inaccurate analog output signal



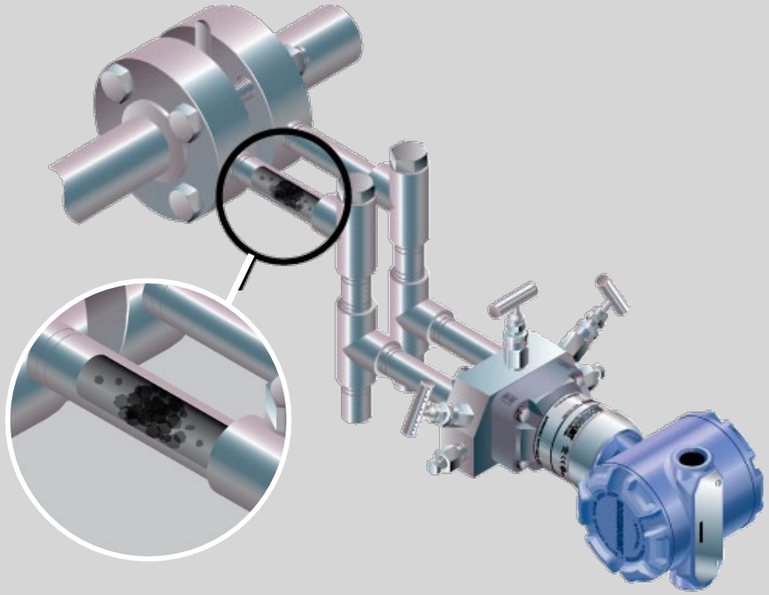
Benefit:

- Ensures the correct transmitter loop current signal is delivered to the control system
- Avoid controlling your process based on an inaccurate variable

Proactively Identify Process Connection Issues with Plugged Line Diagnostics

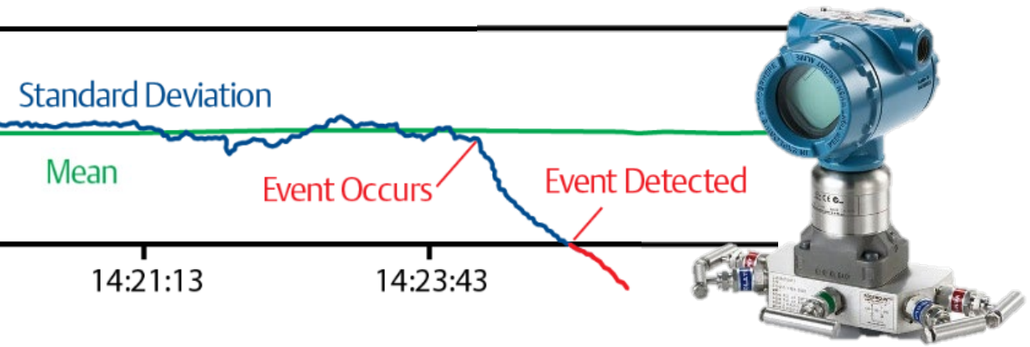
Challenges

- Impulse lines can fill with solid material or freeze in cold environments
- Plugging in one or both lines separates the transmitter from the process
- Transmitter output may appear normal but is unresponsive to process changes



Plugged Impulse Line Diagnostic is the Solution

- **Eliminate unnecessary maintenance**
  Unplug lines only when alerted
- **Optimize maintenance schedules**
  Be more efficient with preventative maintenance
- **Increase process uptime**
  Extend time between maintenance intervals



Plugged Impulse Line diagnostic uses a patented Statistical Processing Monitoring technology that can detect other process connection issues:


Coated/Plugged Annubar


Process Leak


Plugged Orifice Plate Process Taps

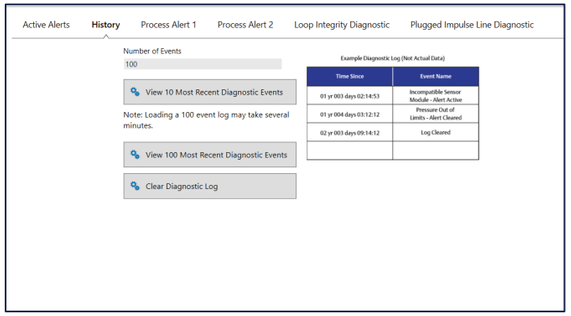

Pump Cavitation


Column Flooding


Flame Instability

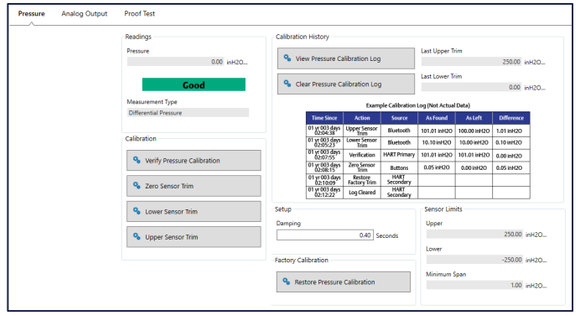
Gain Additional Insight into Device Health with Updated Logs

Diagnostic Log



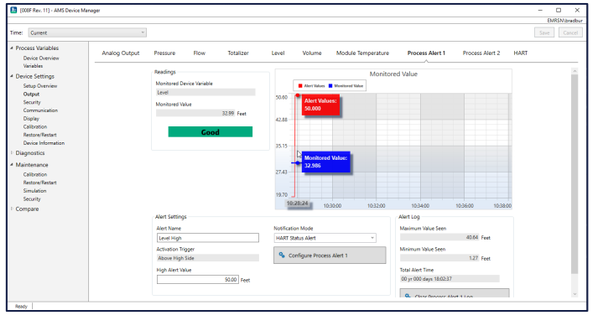
- Stores standard and advanced diagnostic alerts
- Up to 100 events stored

Calibration Log



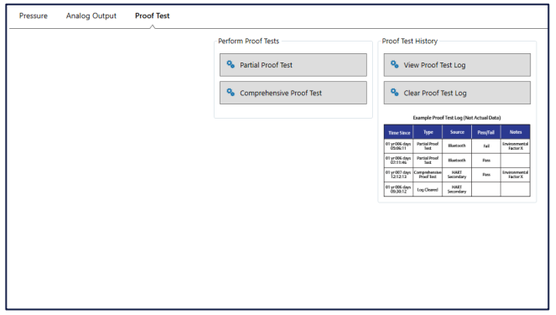
- Stores sensor and analog output trim adjustments
- Sensor verifications are stored when no trim is needed
- Up to 20 events stored

Process Alerts



- Track any dynamic variable (pressure, flow, totalizer, level, volume, or module temp)
- Notified via HART® or analog alarm

Proof Test Log

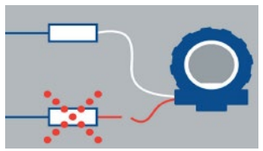


- Captures and stores data when a proof test is performed
- Up to 10 events stored

Temperature

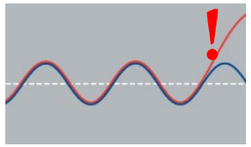
Temperature Transmitter Advanced Diagnostics Help Ensure a Reliable and Accurate Measurement

Temperature installation with Transmitters



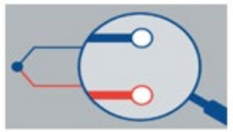
Dual Sensor and Hot Backup

Seamless Transfer from Failed Sensor to Backup Sensor



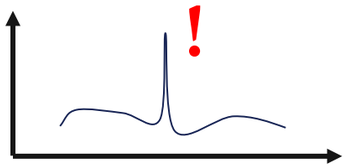
Sensor Drift Alert

Detect Sensor Issue Before Failure by monitoring delta between two sensors



T/C Degradation and Measurement Validation

Identify failing or degrading sensors and connections by monitoring & evaluating sensor loop resistance sensor signal noise

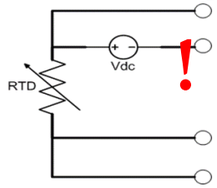


Transient Filtering

Prevent intermittent transient signals from affecting the measurement

Line Voltage Filtering

Noise from AC power sources can easily degrade low-amplitude sensor signals



EMF Compensation

Filter small voltages from RTD installations eliminating errors from measurement

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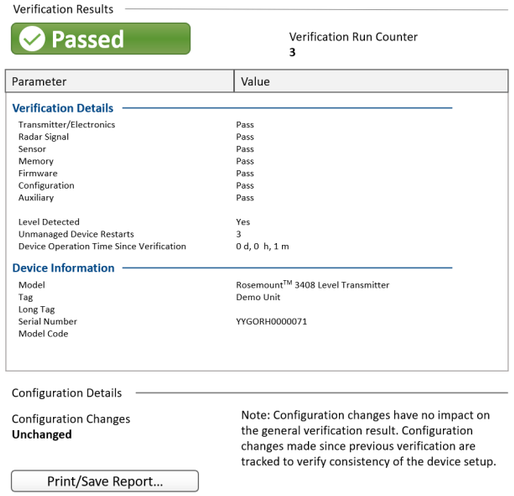
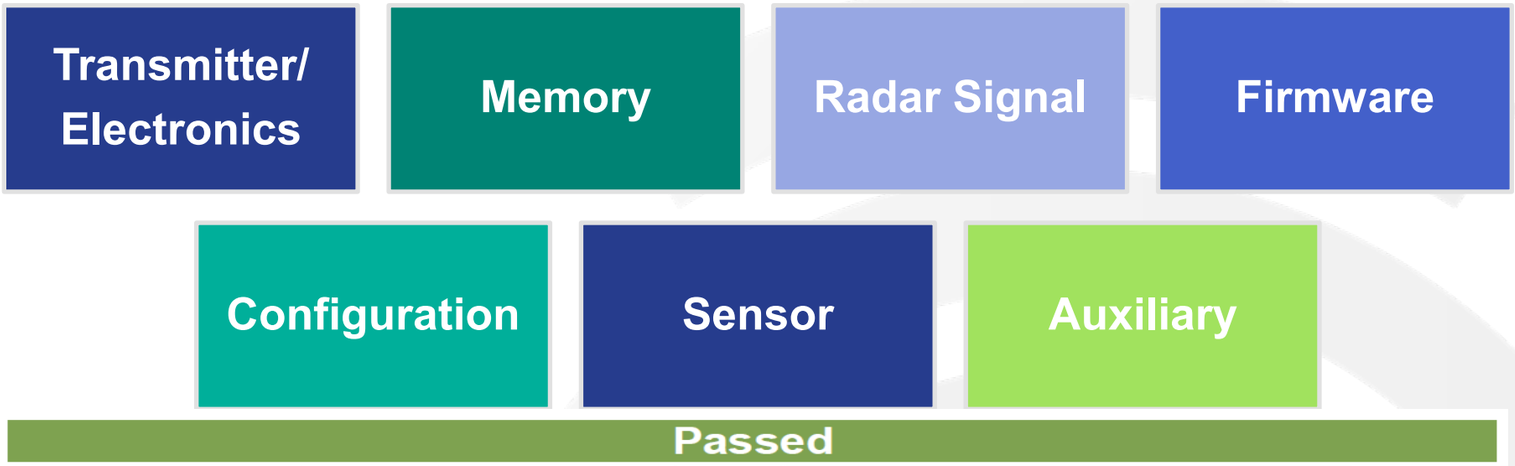
Level

Smart Meter Verification for Highest Performance Confidence

SMART METER VERIFICATION



- Comprehensive health check on the spot for absolute **confidence** in your meter
- Leveraging advanced on-board diagnostics to ensure **performance** and **integrity** of all components and configurations.
- **Schedulable**, **remote** in-situ verification without interrupting the process
- One button - one **clear pass/fail answer**, no extra equipment needed.
- Configuration change assessment for easy **deviation detection**
- Verifies level signal is detected
- **Optimize compliance** with automatically generated printed reports

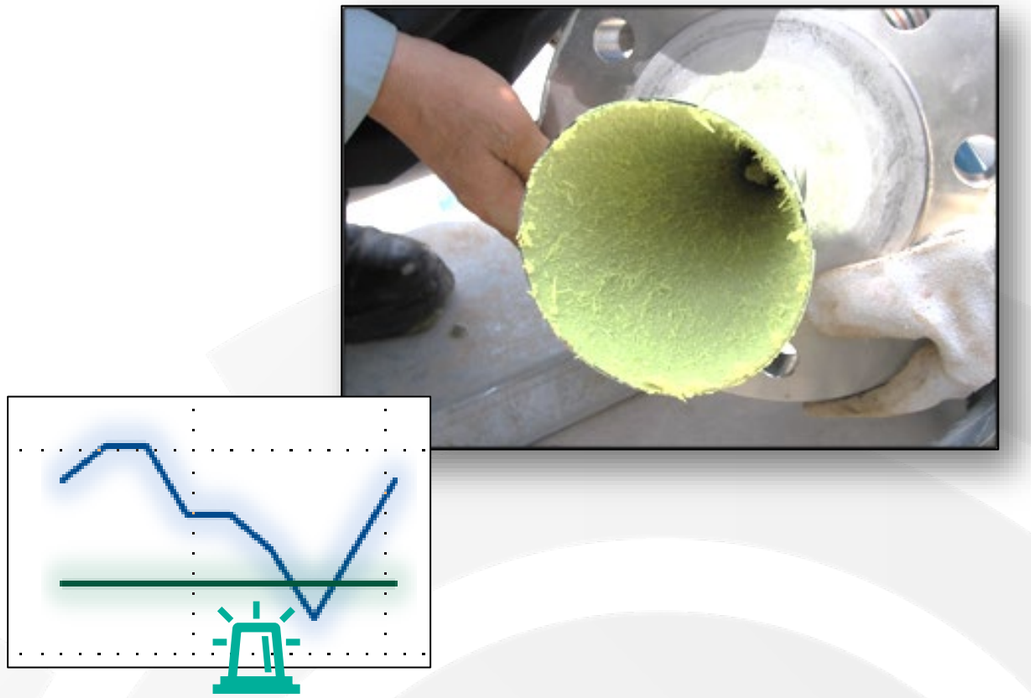


Signal Quality Metrics for Preventive Maintenance

How Can You Tell What's Going On Inside The Vessel? Could Your Level Device Tell You More?

Signal Quality Metrics provides early alerts for issues such as antenna build-up or abnormal surface conditions, enabling proactive maintenance and minimizing downtime.

- Generates comprehensive metric for Signal Quality indicating measurement health
- Signal Quality can be mapped as a HART variable
- Maintenance alert received if Signal Quality is low
- Continuous monitoring for coating/build-up on probe/antenna
- Monitoring of product surface conditions



Proof Test Package for Safety

Have you been struggling to carry out proof tests? Proof test wizards guides users through every step

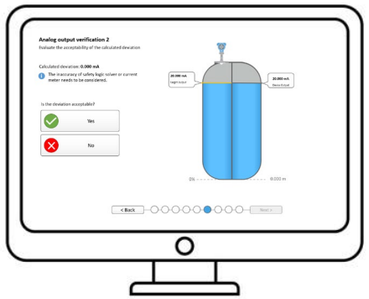
Proof Test Wizards

Follow clear on-screen step by step instructions with dynamic graphics

Last performed test (type, result, and date) saved in on-board memory

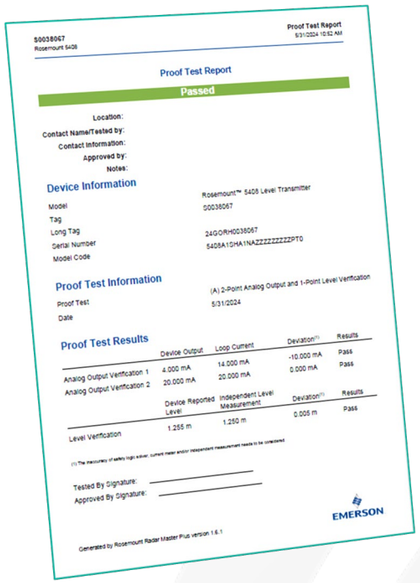
Compatible with all proof tests, both comprehensive and partial

Can be used to initiate remote testing



Printable Report

Time-stamped PDF report upon completion with detailed test results



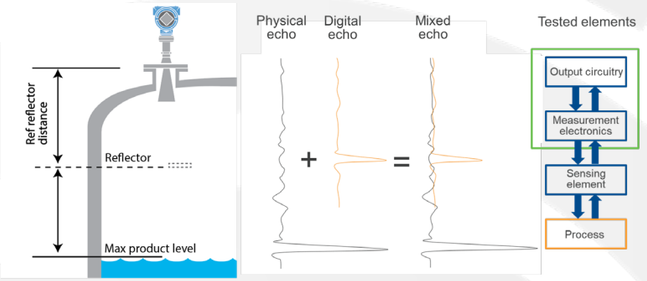
Smart Echo Level Test

Test in a real tank environment without changing actual level

Ensure correct alarm response

For high- and low-level testing

Increase interval between comprehensive proof tests

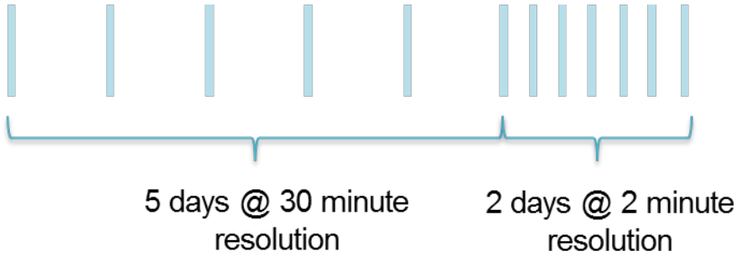


Set Digital Echo at level to be tested and run Proof-Test

Have You Ever Had a Unit Trip and Have no Way to Find Out What Happened?

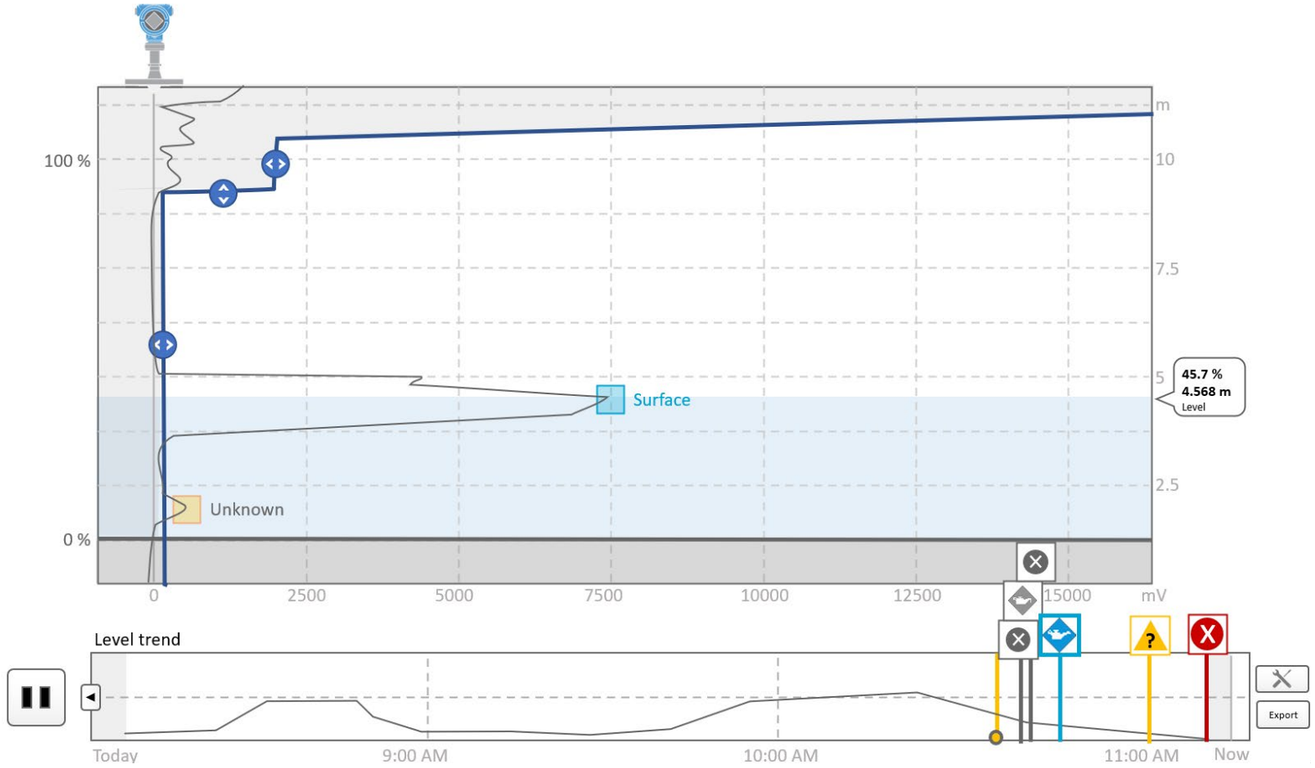
Echo Curve Tool for intuitive advanced troubleshooting lets you go back in time and ensures that you are in full control of your plant

Instrument **saves measurement and echo curve data** in on-board memory



Access up to 7 days of stored data and **analyze measurements, alerts and echo profiles**

Go back in time for troubleshooting and process insights - don't wait for it to happen again

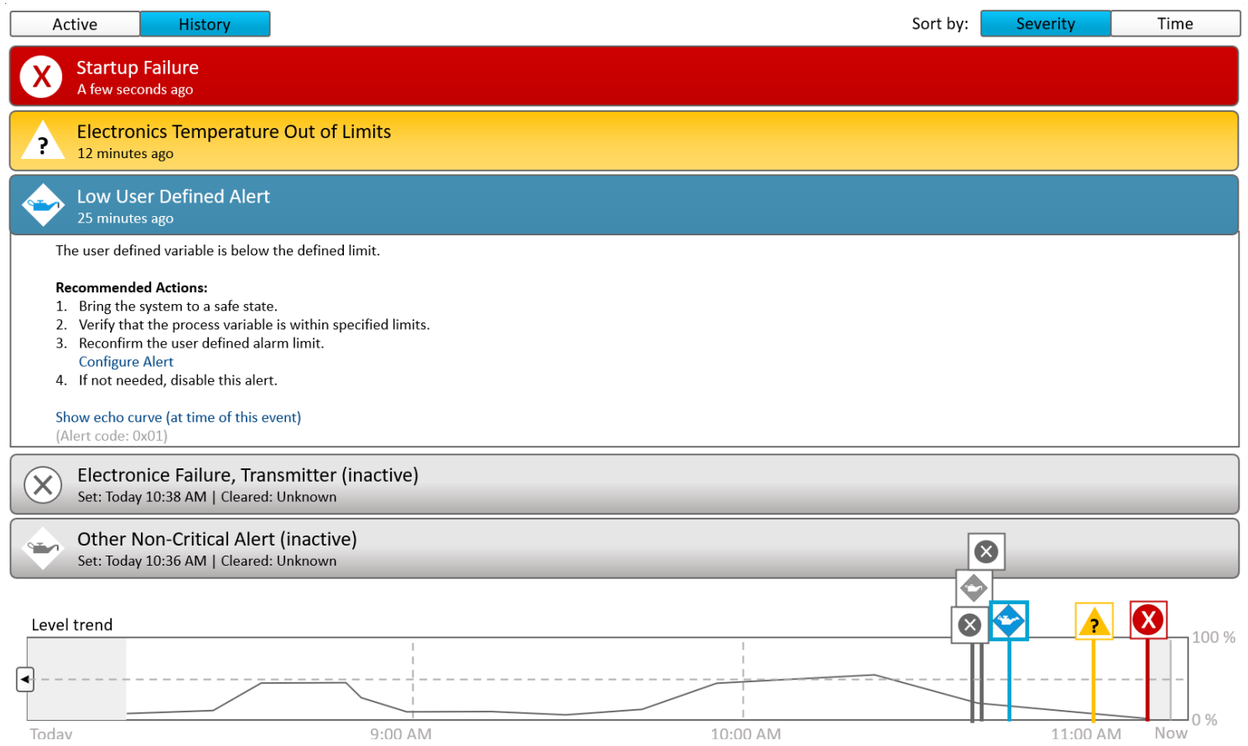


Have You Ever Had a Unit Trip and Have no Way to Find Out What Happened?

Alert Historian with Echo Curve Data gives you the possiblity to review what has happened and compare alerts with the echo curve

Instrument saves, sets and clears events for all alerts together with echo curve data

Possibility of checking echo curve at time of event

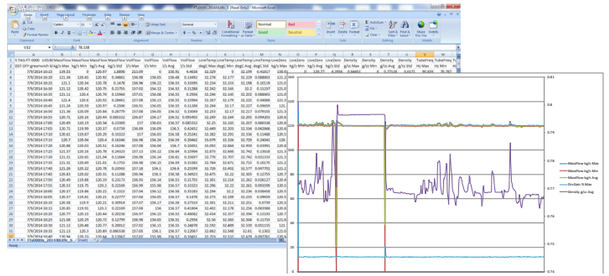


Coriolis

Micro Motion™ Process Analytics

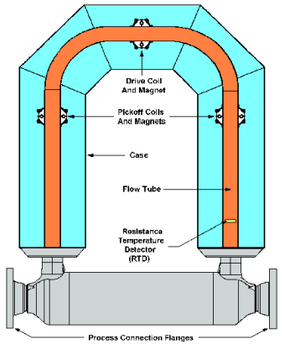
Event Log and Data Historian

- 13 Critical variables logged continuously
  - 30 or 7 days at 1 sec (5700/1600 transmitter)
  - 10 years/ 30 days at 5 min (5700/1600 transmitter)



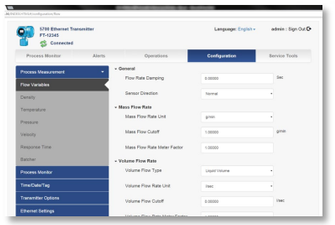
Drive Gain

- “A Window into the Process”
  - The amount of energy required to keep the sensor tubes vibrating at their natural frequency



Configure and Analyze

- Several user-friendly tools to easily configure and troubleshoot transmitters



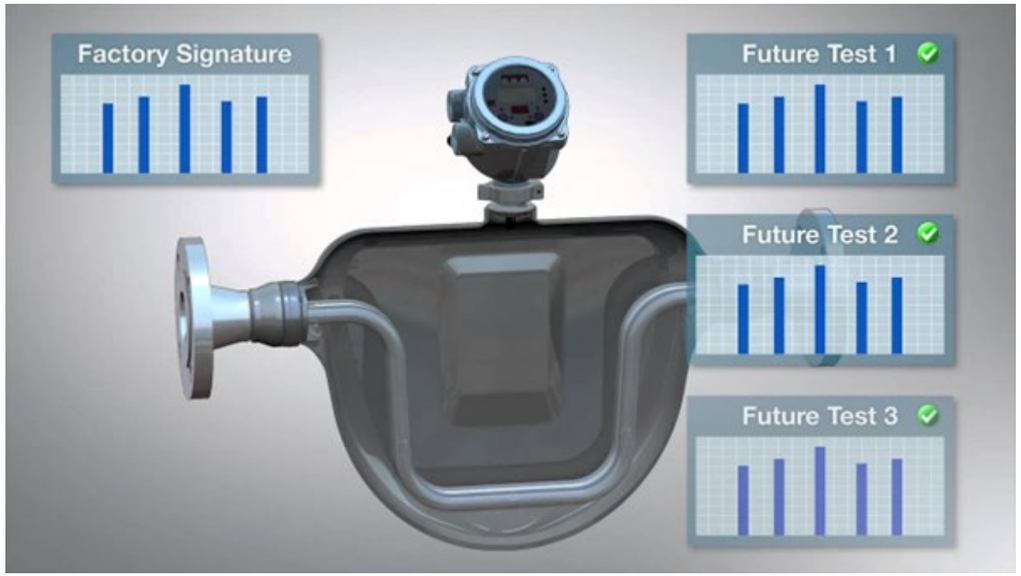
Audit Log

- Provides Time and Date stamp for changes such as:
  - Configuration
  - Zero
  - Meter factor/ Sensor info change

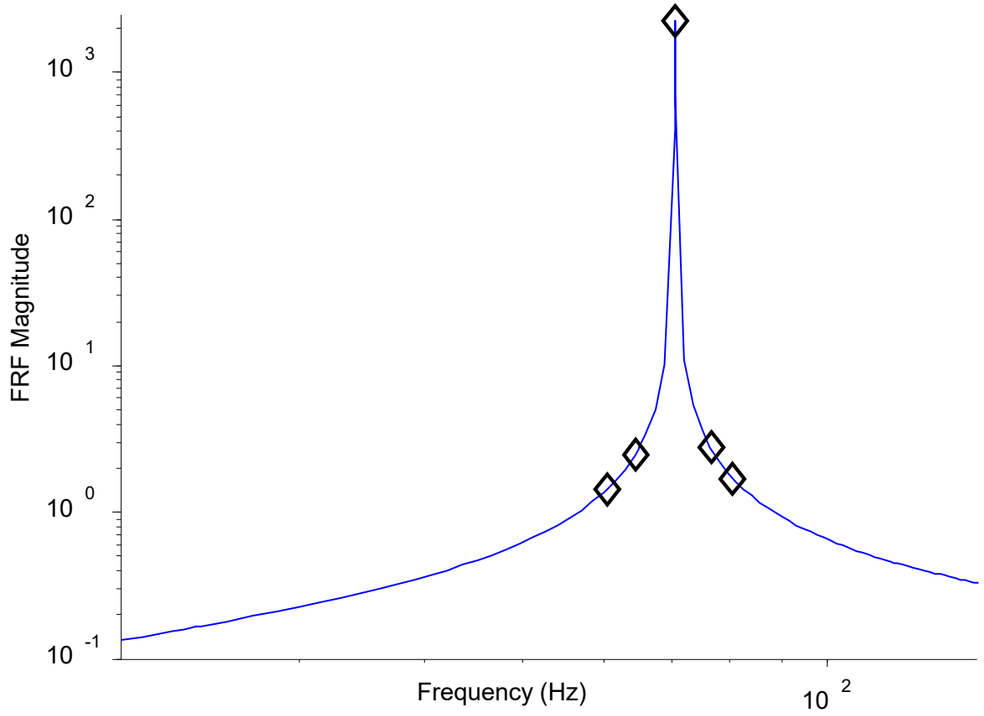
```
Device UID: BE0CF912
Device Tag: FT-0000

 Addr   Name           Old Value     New Value     Unit  Time Zone: GMT +0.00 Host
13128 SYS_SoftwareRe 25            41                    11/SEP/2014 16:01:40 Other

11/SEP/2014 17:54:30
power cycle occured
13128 SYS_SoftwareRe 41            43                    11/SEP/2014 17:54:28 Other
189   SNS_DampingFlo .640          .840                  12/SEP/2014 14:52:50 Display
211   MAO_1_mA4Var   -26.4550      0             lb/m    12/SEP/2014 14:57:16 Display
209   MAO_1_mA20Var  26.4550       40.0          lb/m    12/SEP/2014 14:57:47 Display
```

Smart Meter Verification Evaluates Meter Under Normal Operating Conditions

- Coriolis meter's Frequency Response Function (FRF) is a function of the **mass**, **damping**, and **stiffness**
  - **3 unknowns**
- SMV drives meter at **5 frequencies** to define **FRF**
  - Can solve **3 unknows** with **5 Data points**
- With the **FRF**, we can calculate current **stiffness** and compare to the baseline.



Frequency Response Function (FRF)



What is the Value to You?

My process is susceptible to corrosion. How do I know when it has become a problem?

Is my meter broken or installed incorrectly? Or is the process affecting how the meter performs?

Something is wrong in my process. How can it affect my measurement?

Recalibrations take time and money. Can I reduce their frequency?

With Smart Meter Verification, you can:

Eliminate Uncertainty

- On-demand or scheduled verification assures critical flow point measurement, meter health and stability

Reduce Costs

- Saves thousands in expenses for labor and outsourced calibration services

Simplify Compliance

- Establishes an audit trail for each meter with stored results

Increase Uptime

- Confirms meter health and performance without removing the meter from the line or stopping process flow

Improve Quality & Safety

- Avoid unnecessary trips to the field and testing procedures that break the process seals

There are many unknowns that can have far-reaching implications in your process -

Do you have total insight into your process?

Success Story: Petrochemical Plant Reduces Custody Transfer Proving Costs

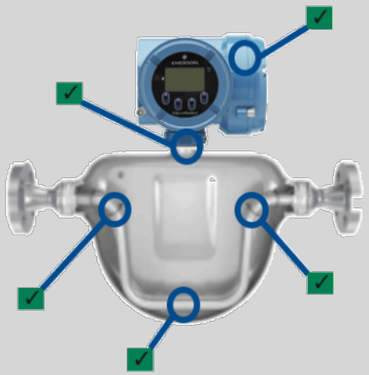
Reliability Challenges

- High cost of ensuring custody transfer meters were maintaining their accuracy
- One hundred meters needed to be verified twice per year without shutting down the process
- Each meter was bypassed and surveyed manually to check calibration

Value Improvement Practice

Micro Motion Coriolis meters

- Smart Meter Verification enables in-situ verification the meter calibration has not degraded
- Integration of SMV into DCS system for remote in-situ testing versus manual surveillance



SMART METER VERIFICATION

Impact on Operations

$100,000 in-situ testing savings
($500 per unit X 100 meters X 2 times per year)

$400,000 savings not having to bypass meter run to perform routine maintenance
($2,000 per occurrence x 100 meters x 2 times per year)

$300,000 savings on unplanned downtime averted by detecting meter degradation
($100,000/day X 3 days to get new meter)

$800,000 total savings

3 Month Payback

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Non-intrusive ultrasonic flow meters

Flexim Advanced Diagnostics Provide Coverage From The Process To The Control Room

Transmitter Health

Health check of non-intrusive flow measurement in depth directly at the measuring point

- Confirmation that the installation was carried out according to specifications
- For checking the measuring conditions, the diagnostic data recorded by the transmitter itself are automatically evaluated.
- The diagnostic data recorded immediately after installation form the reference for regular verification.

Process Intelligence

Spot and Diagnose Process Problems Before Issues Occur

- Regular verification provides an assessment of the change in measurement compared to the initial reference point.
- Changes in the diagnostic values compared to this reference enable early fault detection.
- If the changes indicate a need for maintenance, this is clearly indicated in the verification report as well (fouling detection, process changes)

Verify the performance of non-intrusive ultrasonic flow measurement

- Savings in maintenance and calibration cost due to efficient onsite meter verification
- Transparent statement regarding the health of your flow measurement
- Predictive maintenance via trend evaluation
- Indication of potential improvement measures
- Documentation for your quality management system

Diagnostic values for the assessment of measurement

Gain „G“

Signal attenuation in the fluid and pipe wall

- Indicates weak coupling
- decrease over time can indicate degrading coupling

SCNR (Signal to Correlated Noise Ratio)

Pipe noise

- if SCNR too low, check:
  - distance to flanges
  - pipe damping

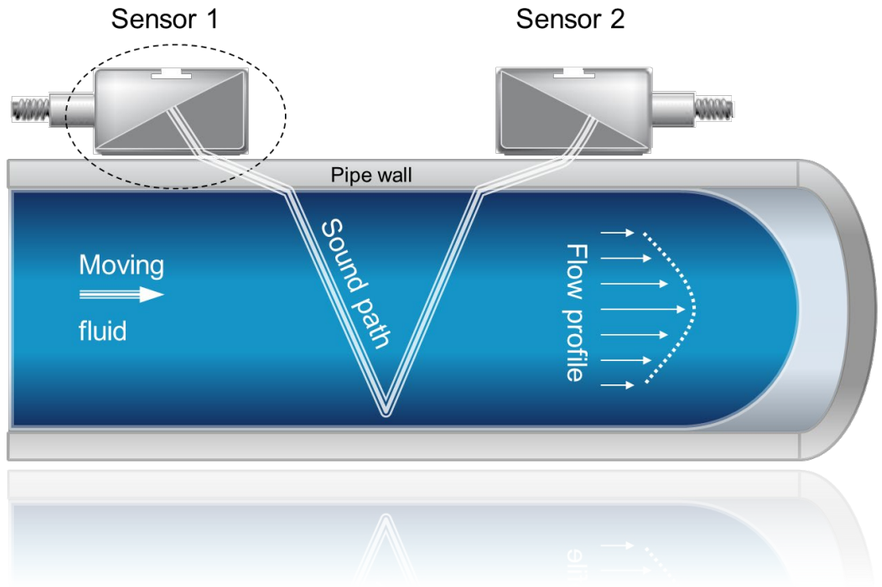
SNR (Signal to Noise Ratio)

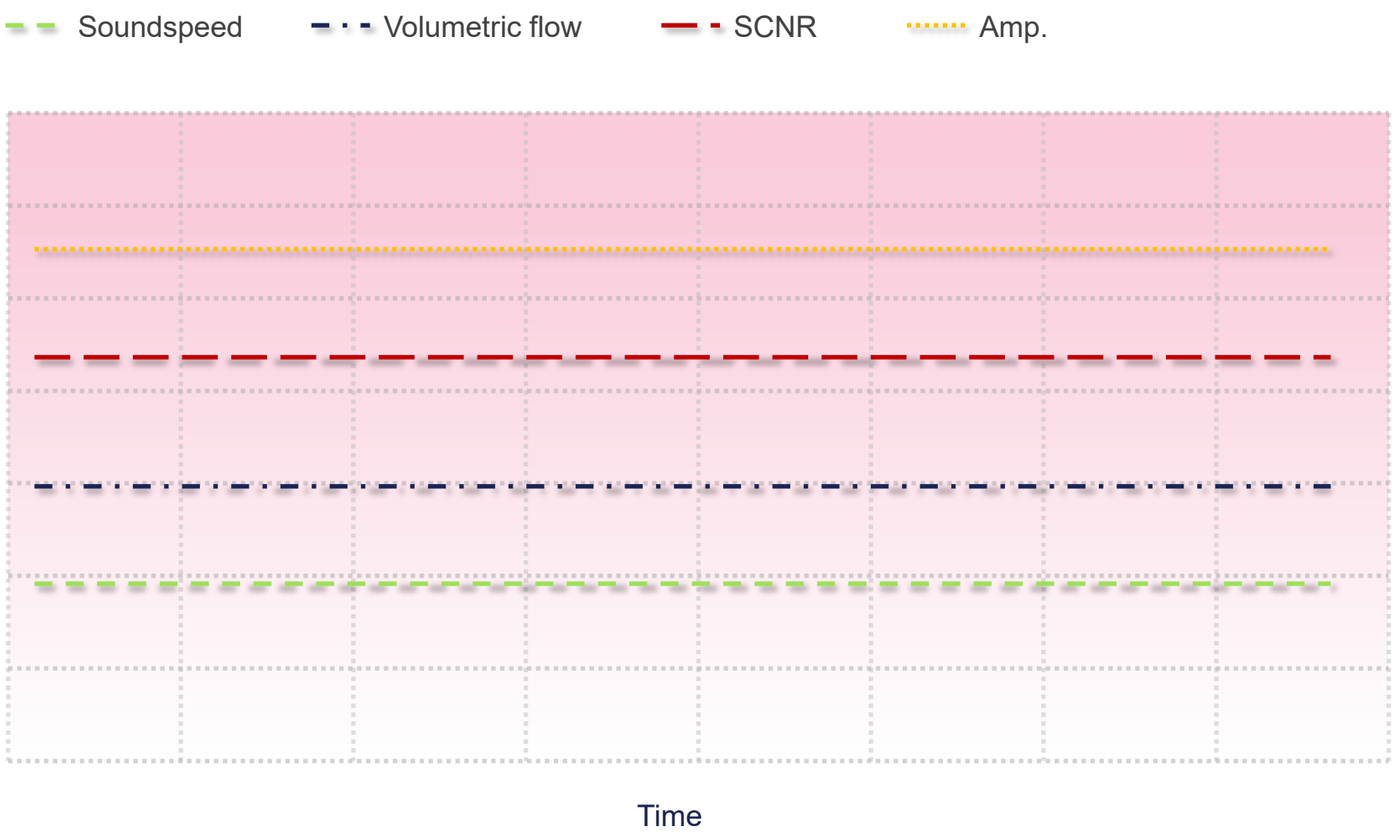
Electrical noise or valve noise

- Low SNR can be caused by:
  - wrong earthing or shielding
  - Transducer cable: shield and signal wire swapped.
  - Valve noise

Fouling Detection

- Wax formation significantly impacts various measuring values. It reduces the internal cross-section, thereby decreasing the fluid transit time. As a result, the measured sound speed and volumetric flow of the fluid increase.
- Diagnostic values are also affected, with the SCNR value decreasing and the Amplification value increasing.





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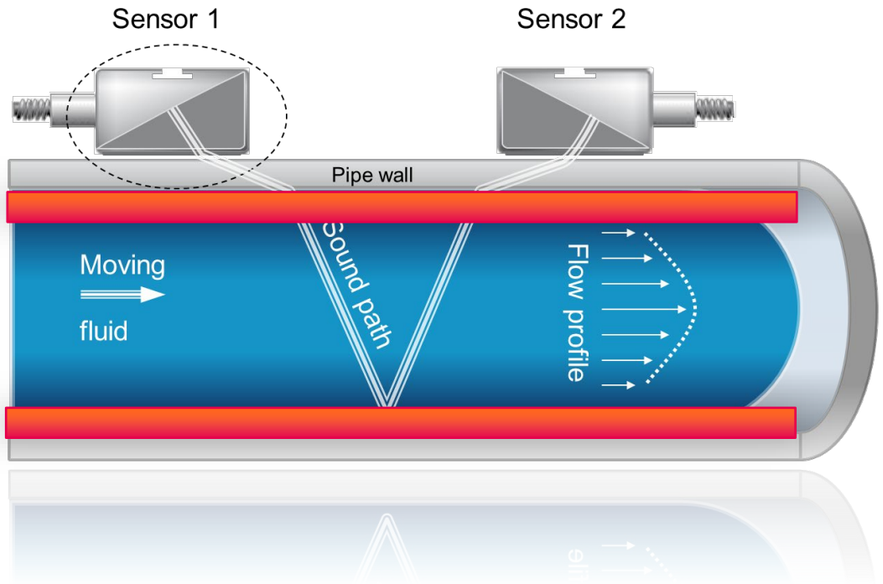
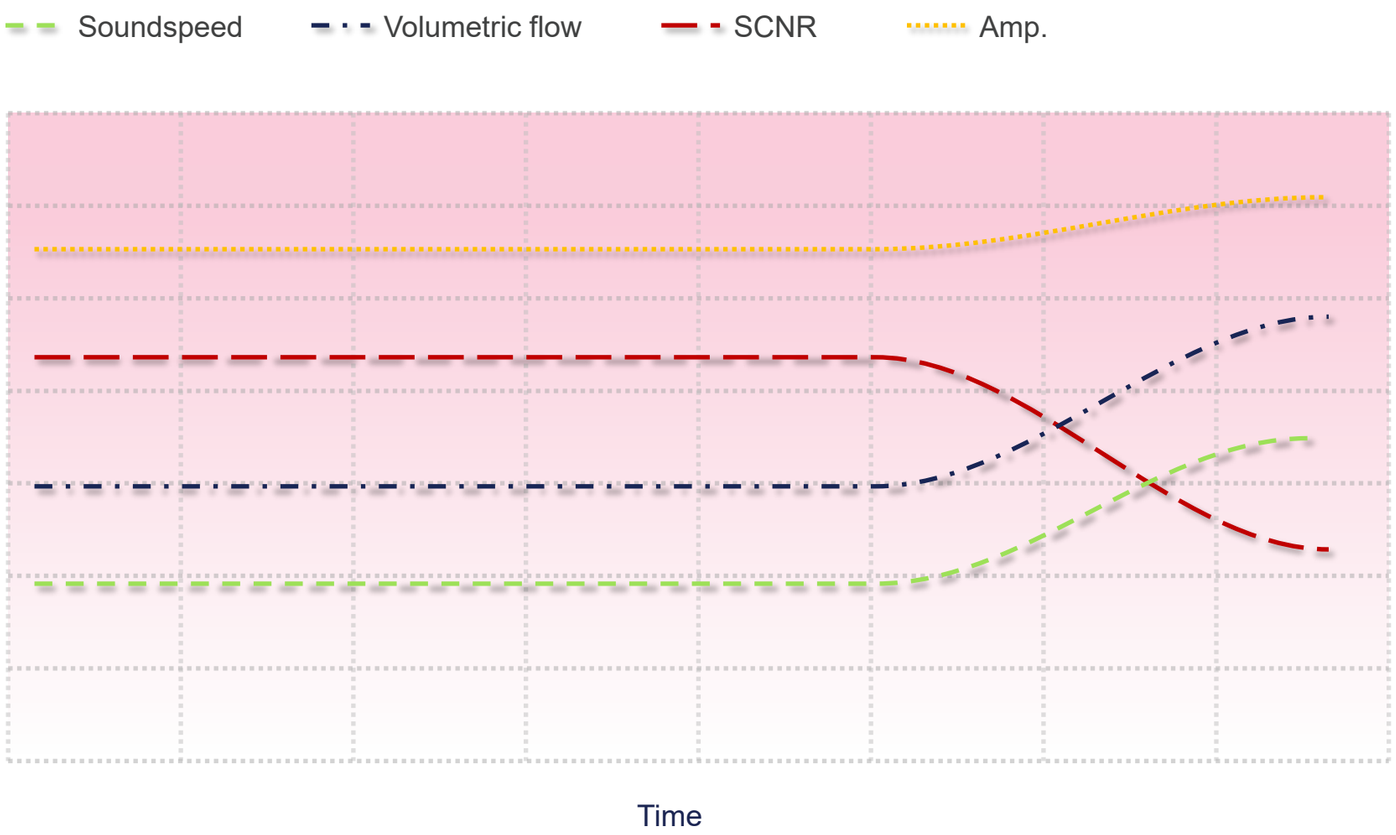
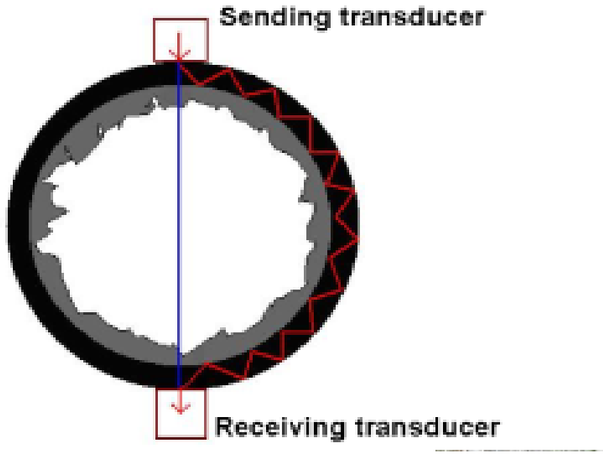




Example: Incrustations at a Refinery

Very often heavy incrustations occur inside the pipes which lead to an interference of the ultrasonic signals and thus to a decrease of the measurements` stability and accuracy



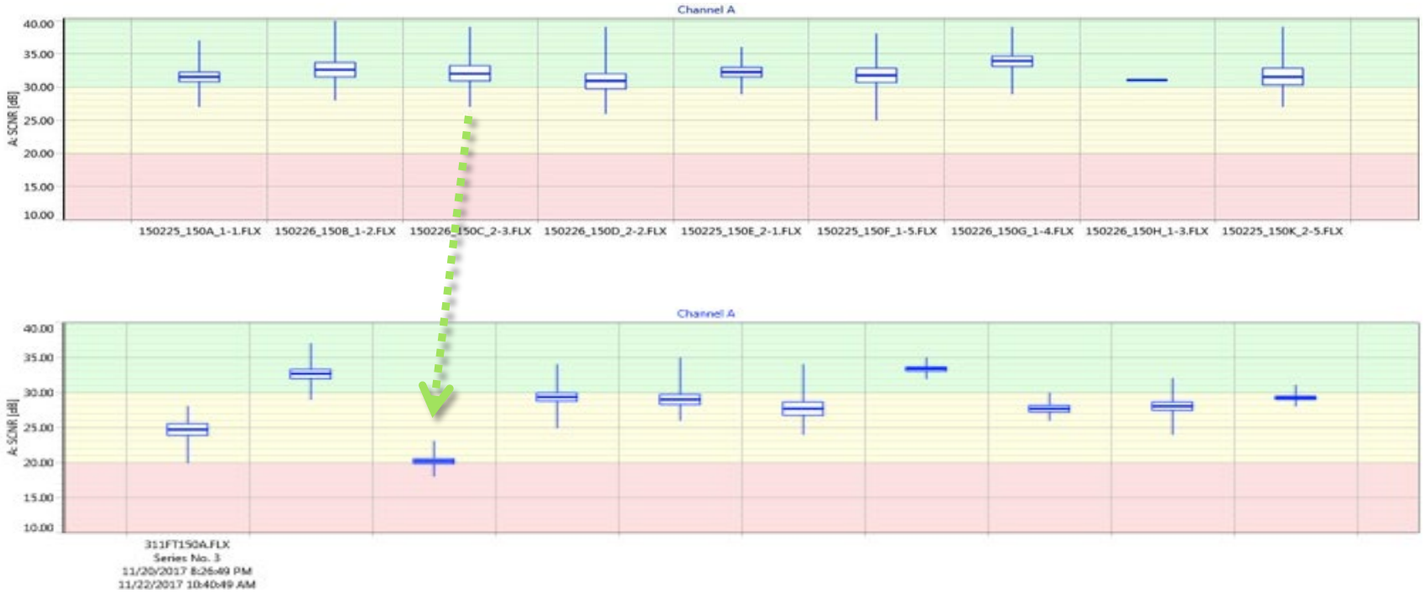
.....for sure other metering systems are already out of order under these conditions!

- We are able to detect changes in process with our Flexim devices by analyzing the diagnostic values.

Comparison of diagnostic data

Performance check of 10 different feedlines (Reduced Crude @365 °C / 6” pipe from VDU)

Target of the analysis was to detect process related changes, to schedule a possible necessary maintenance of the pipe section caused by hydrocarbon specific incrustations.



We see a degradation in some lines, mainly caused by incrustation in this process pipes, but one channel is very close to fail. >> this pipe section needs to be maintained internal cleaning process) immediately.

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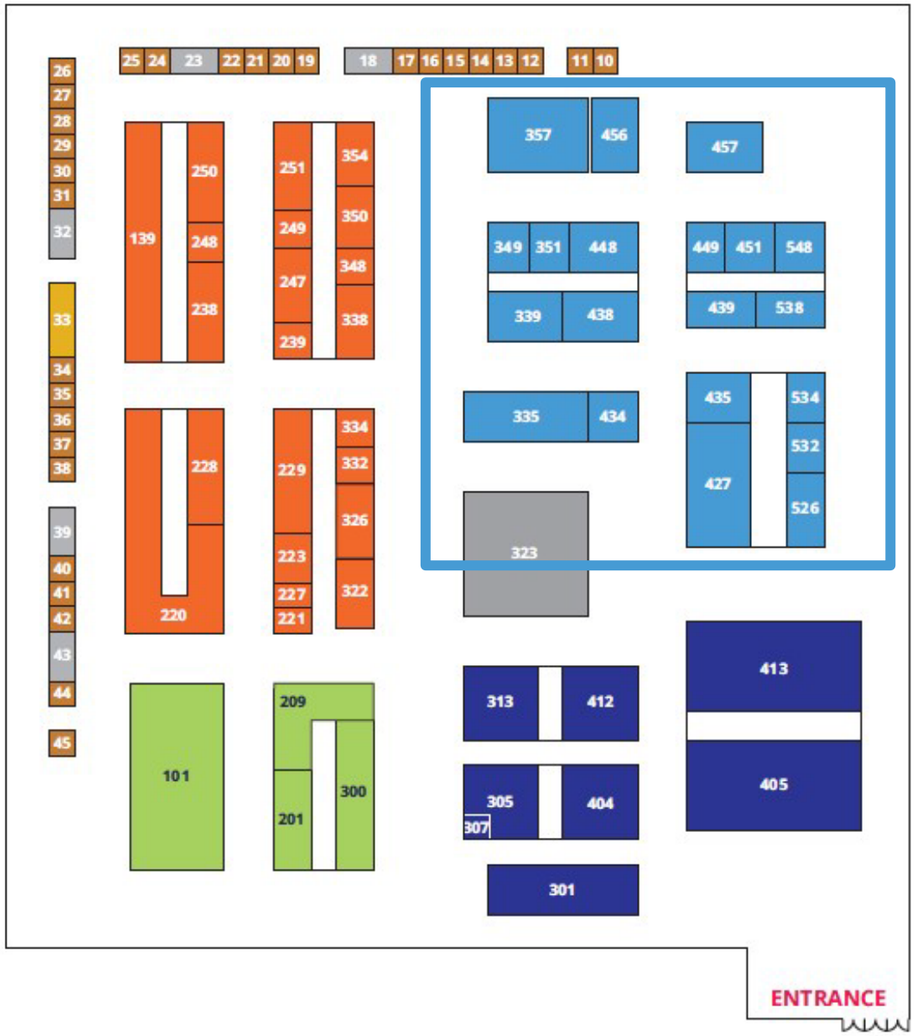

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Thank You