MAGNETROL® / AMETEK®

Elevating Emulsion Layer Level Measurement

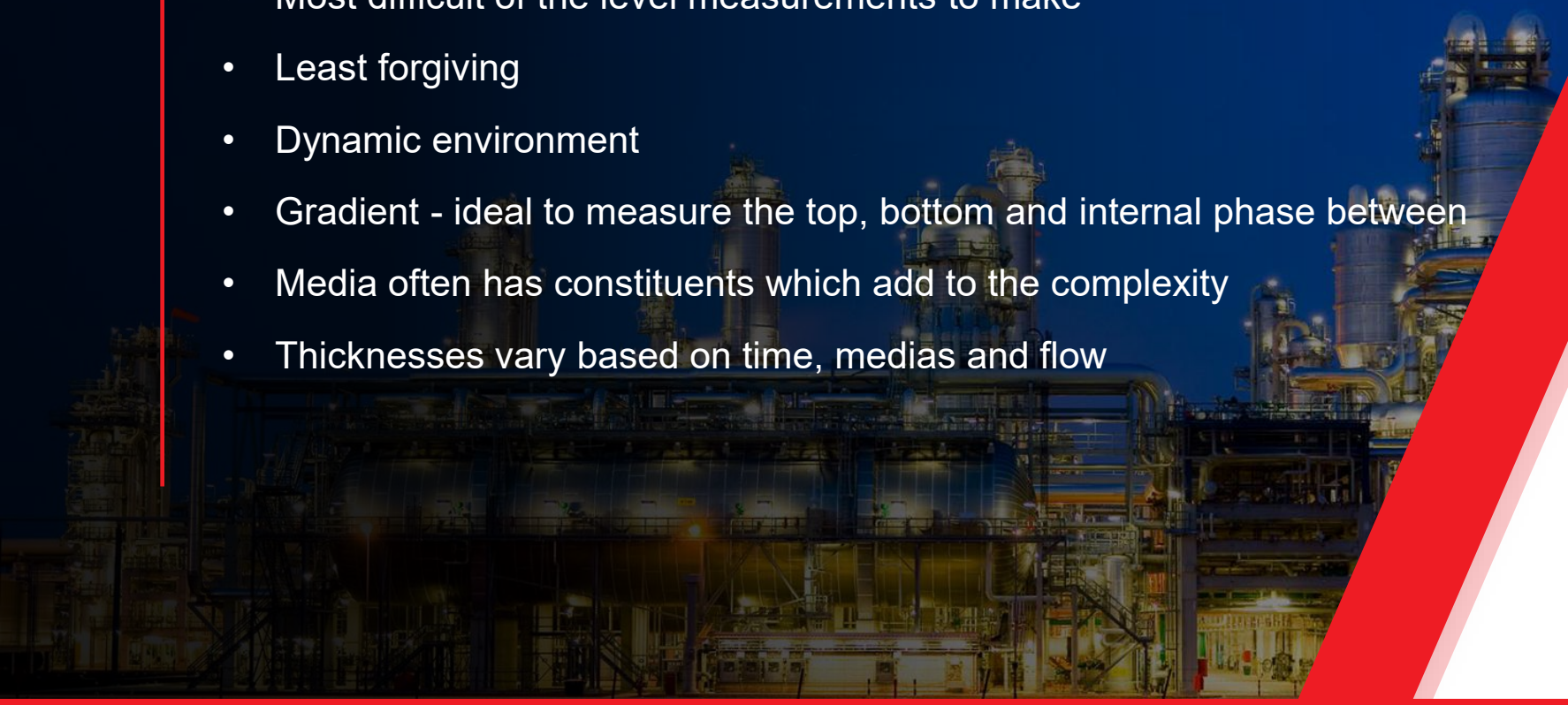
GENESIS ™
MODELS ED1 & ED2

Multiphase Detector
For interface applications with dynamic emulsion layers

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

CHALLENGES

- Most difficult of the level measurements to make
- Least forgiving
- Dynamic environment
- Gradient - ideal to measure the top, bottom and internal phase between
- Media often has constituents which add to the complexity
- Thicknesses vary based on time, medias and flow



BEST OF BREED

A single point of entry into your production vessels

- No HSE (health, environment & safety) concerns
- 4 phase detection (Absolute Level; Emulsion Top; Emulsion Bottom; Sediment) impacting:
  - Product quality
  - Unplanned shutdowns
  - Process optimization / Cost control
  - System integrity
- Superior uptime and reliability
- Low TCO (total cost of ownership)
- Outstanding ROI

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

DETECTING TOP AND BOTTOM
OF THE EMULSION

MULTIPHASE MEASUREMENT AND CONTROL

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

VARIOUS APPLICATIONS
IN A VARIETY OF INDUSTRIES

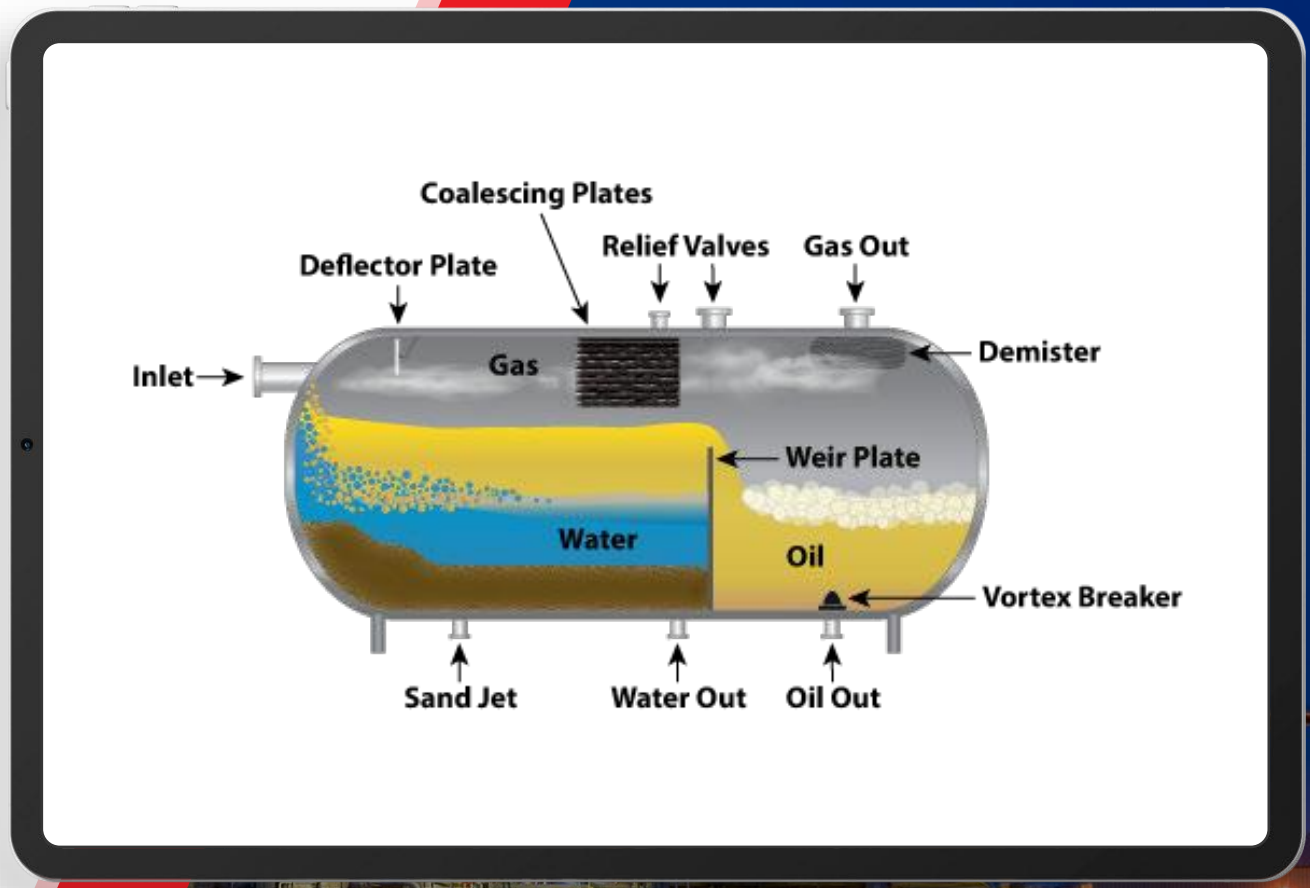
INTERFACE MEASUREMENT

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

MULTIPHASE MEASUREMENT AND CONTROL

One of the toughest measurement challenges in the industry is the hydrocarbon/water interface measurement, such as in a separator

Knowing the position and thickness of an interface emulsion is critical for maintaining **process control, quality, efficiency and profitability**

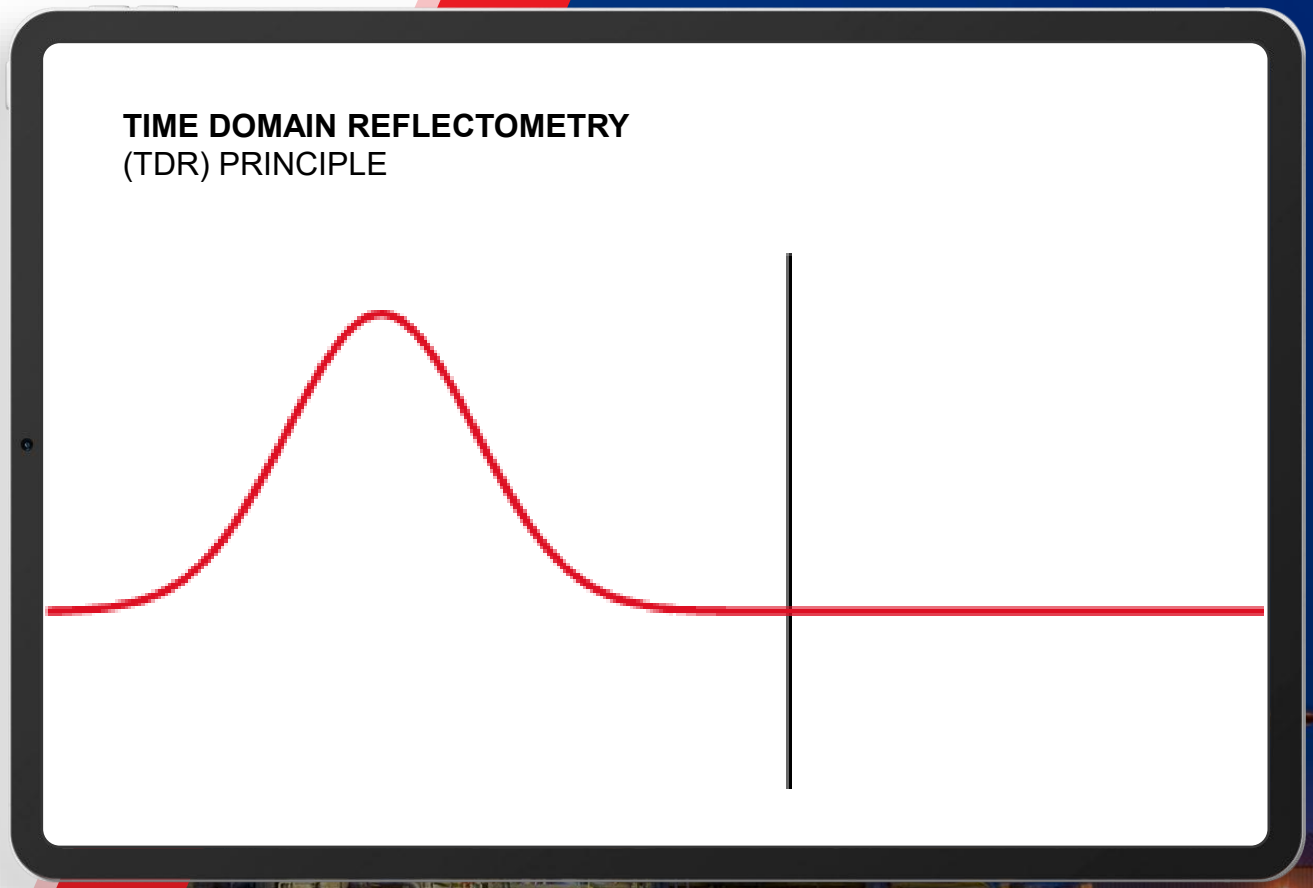


AMETEK®
LEVEL MEASUREMENT SOLUTIONS

TIME DOMAIN REFLECTOMETRY

?

Pulses of energy are sent down a probe and precision timing circuitry measures the reflection of the signal off the surface of the process



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

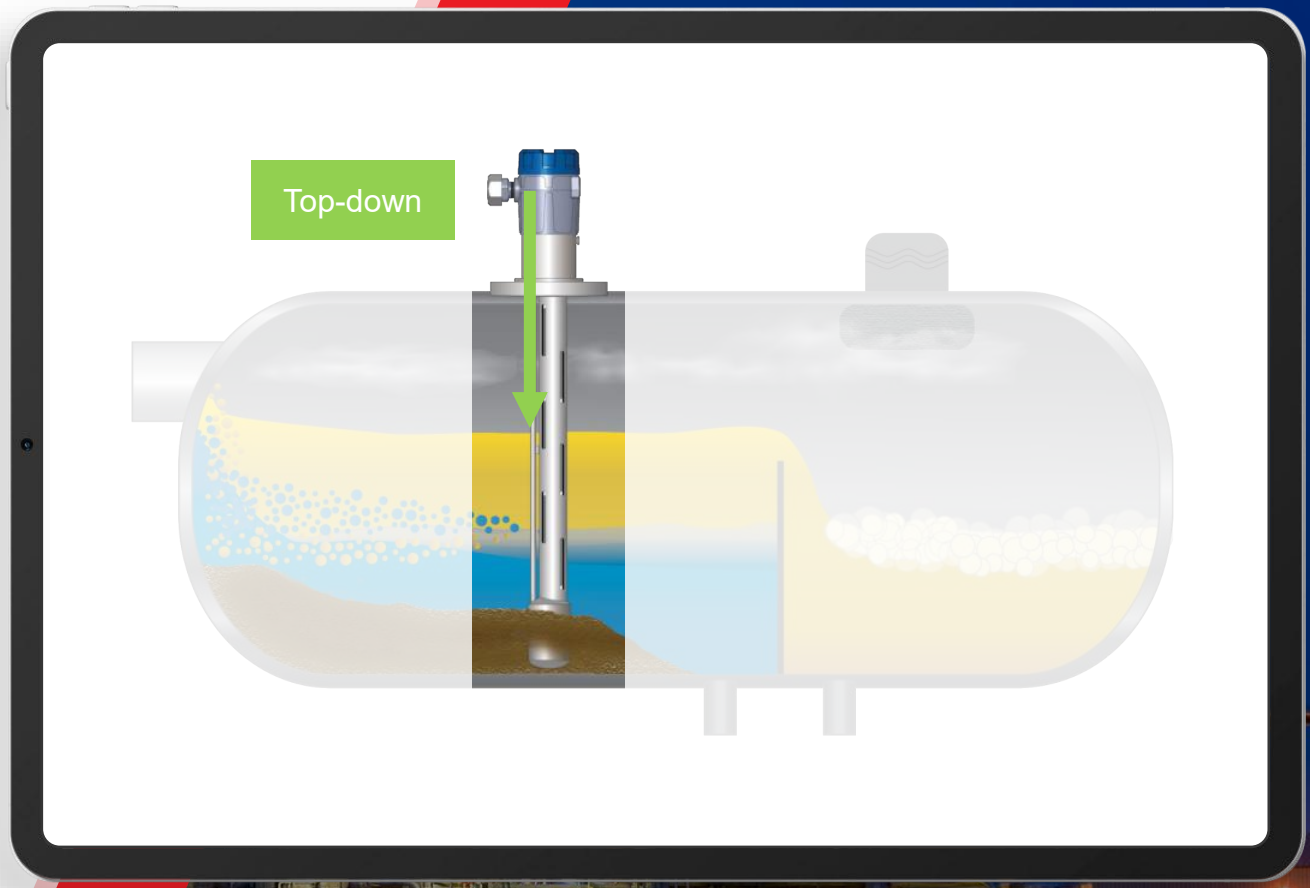
GENESIS:
MULTIPHASE DETECTOR

PATENTED INTERNAL ALGORITHM

Separates the various signals

Top-Down TDR

Fires pulses down the probe, like most level transmitters



01 Analyses the waveform to locate the upper level and top of emulsion

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

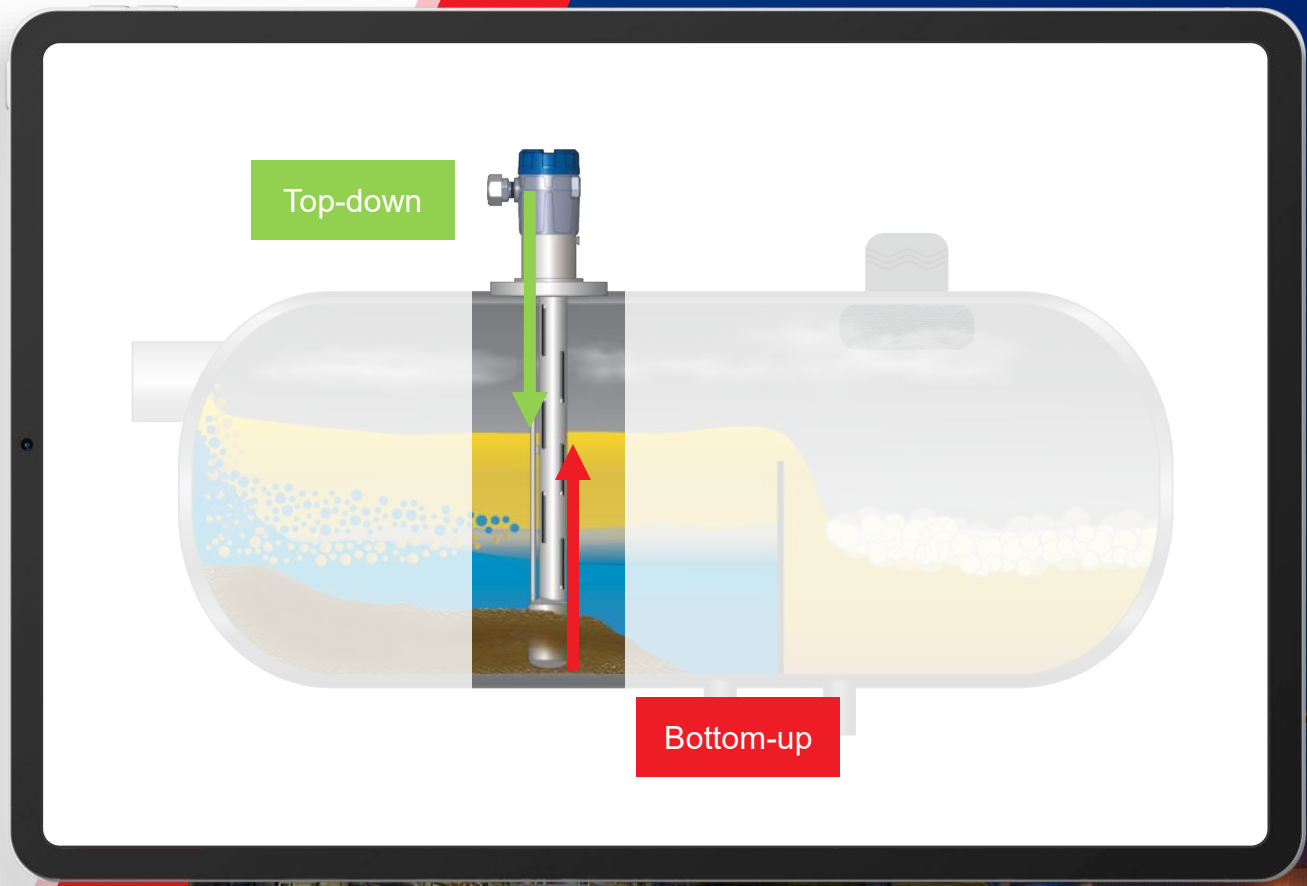
GENESIS:
MULTIPHASE DETECTOR

PATENTED INTERNAL ALGORITHM

Separates the various signals

Bottom-Up TDR

Fires pulses up, through the water, at the bottom of the emulsion



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LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR

NARROW
PULSE

STEP

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

DESIGN
CONCEPT

STEP

A clean interface gives a sharp reflection, so the step function offers no more information than the narrow pulse

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LEVEL MEASUREMENT SOLUTIONS

DESIGN
CONCEPT

An interface with tapering dielectric gives little reflected energy with the narrow impulse, however, the step response visibly ramps up

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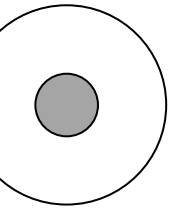
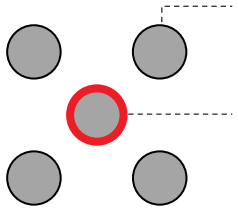
LEVEL MEASUREMENT SOLUTIONS

GENESIS MULTIPHASE DETECTOR



Probe
Coaxial Transmission Line



Four outer reference rods form shield, less buildup

PFA jacket allows pulse to travel through water

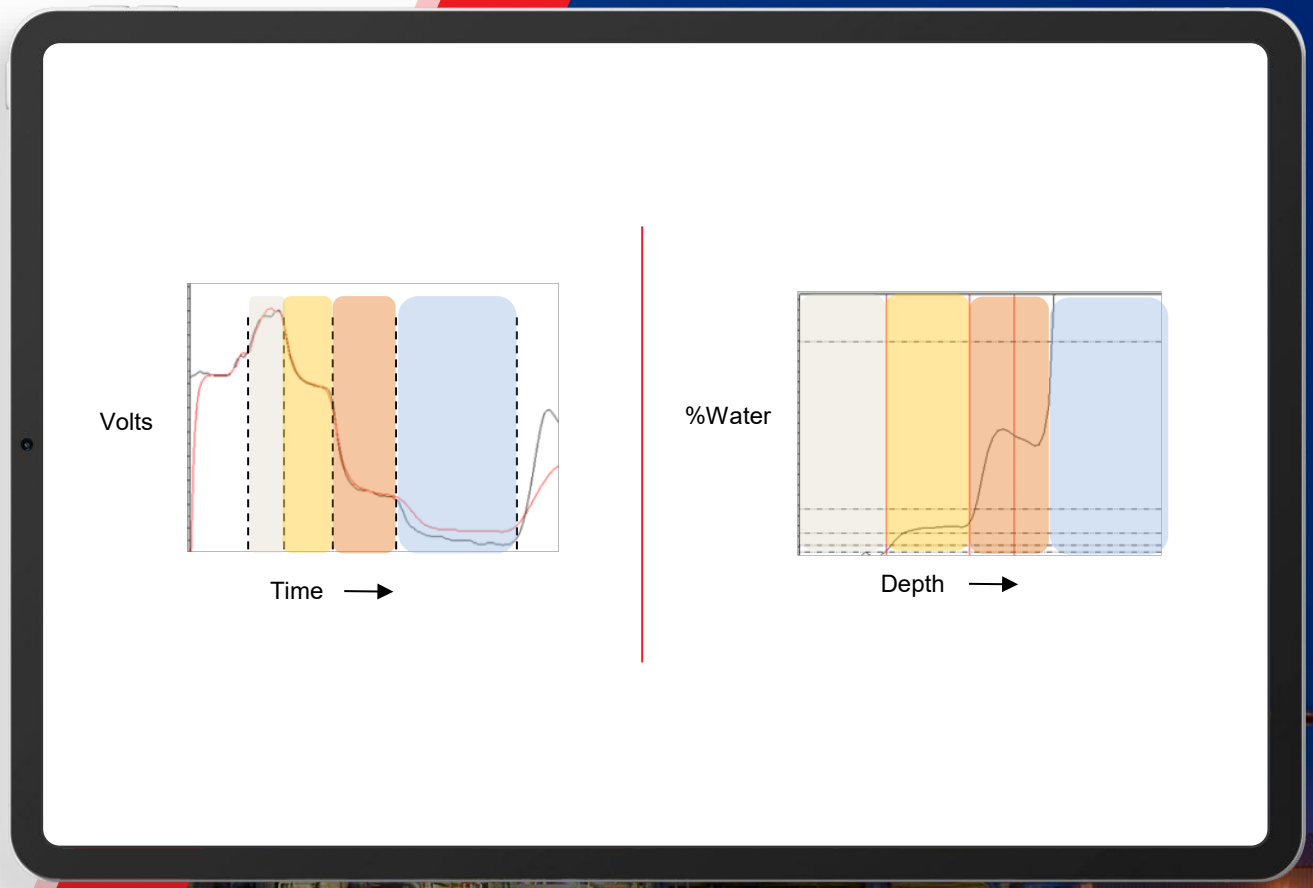
AMETEK®
LEVEL MEASUREMENT SOLUTIONS

INVERSE RECONSTRUCTION ALGORITHM (IRA)

Converting the TDR waveform to:

Percent Water vs. Distance

Voltages are incrementally measured along the TDR waveform across the entire length of the probe



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

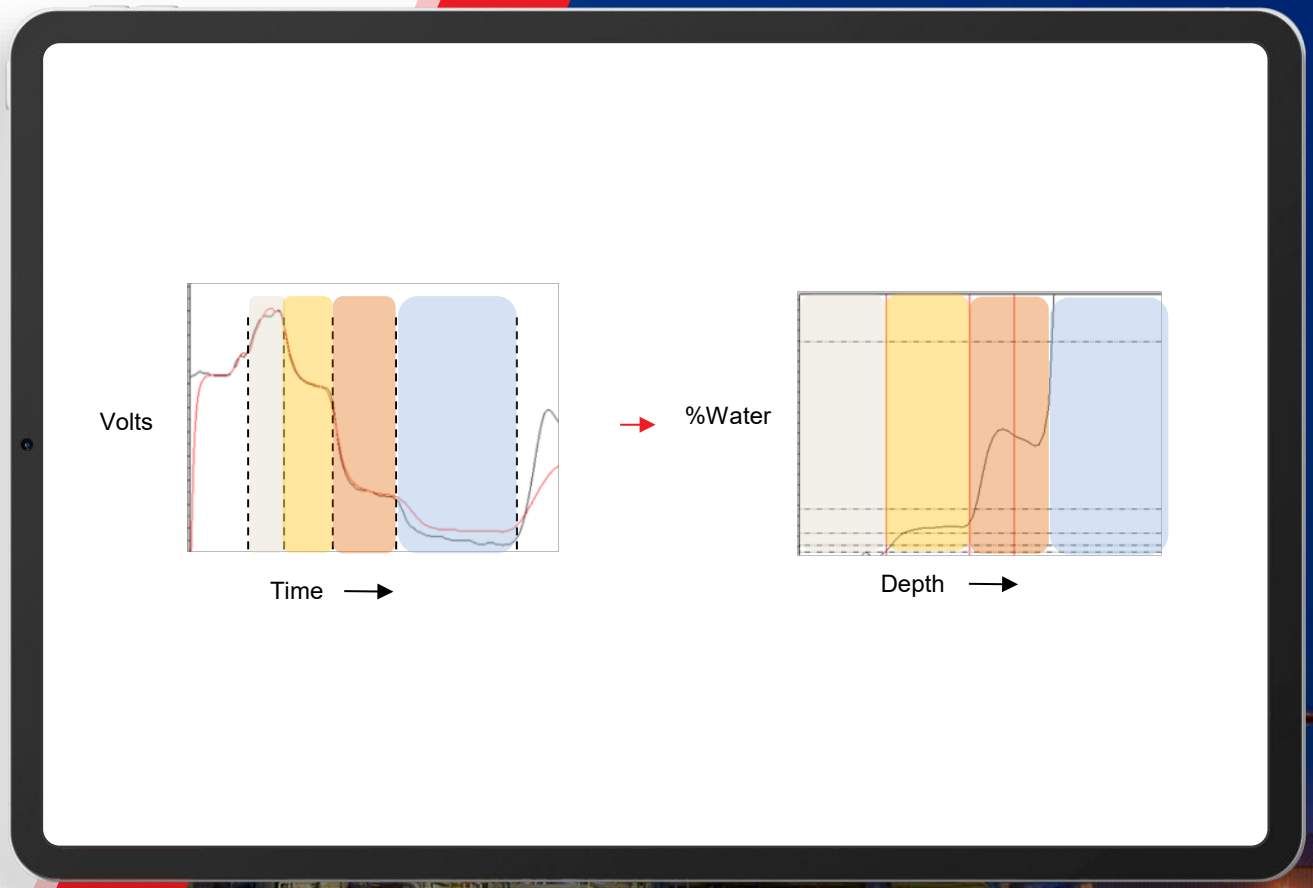
DESIGN CONCEPT
GENESIS : MULTIPHASE DETECTOR

Genesis measures the TDR Waveform, and maps that to Percent Water versus Distance

This is accomplished by :

01 Creating a simulation of the probe and the fluid

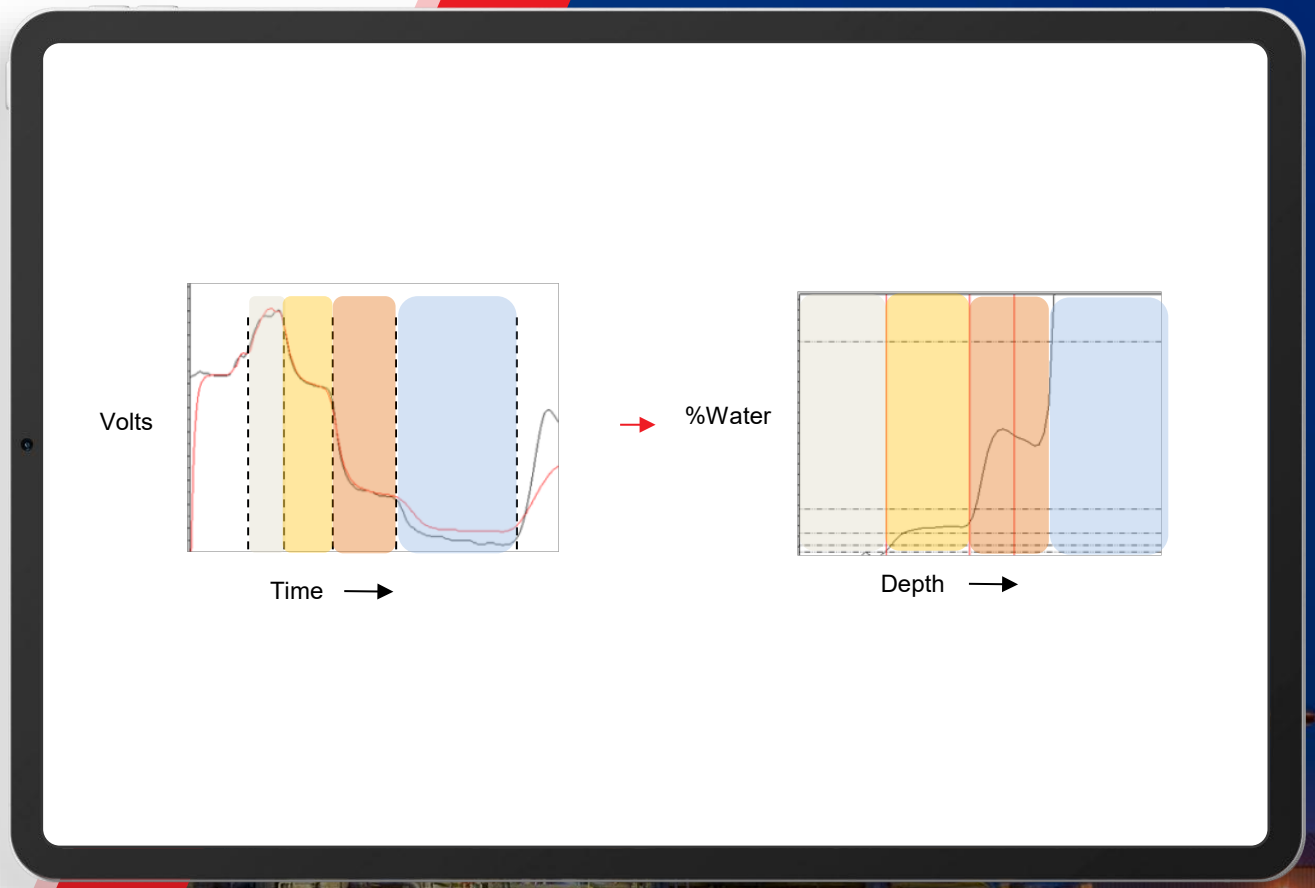
02 Calculating what layers of fluid would give a TDR signal that matches the measured signal



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

THE RESULT

These demanding and interlaced calculations solve the issues with multiple-reflections, compensation, and tapering emulsions



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE LEVEL DETECTOR

FOUR MAIN COMPONENTS

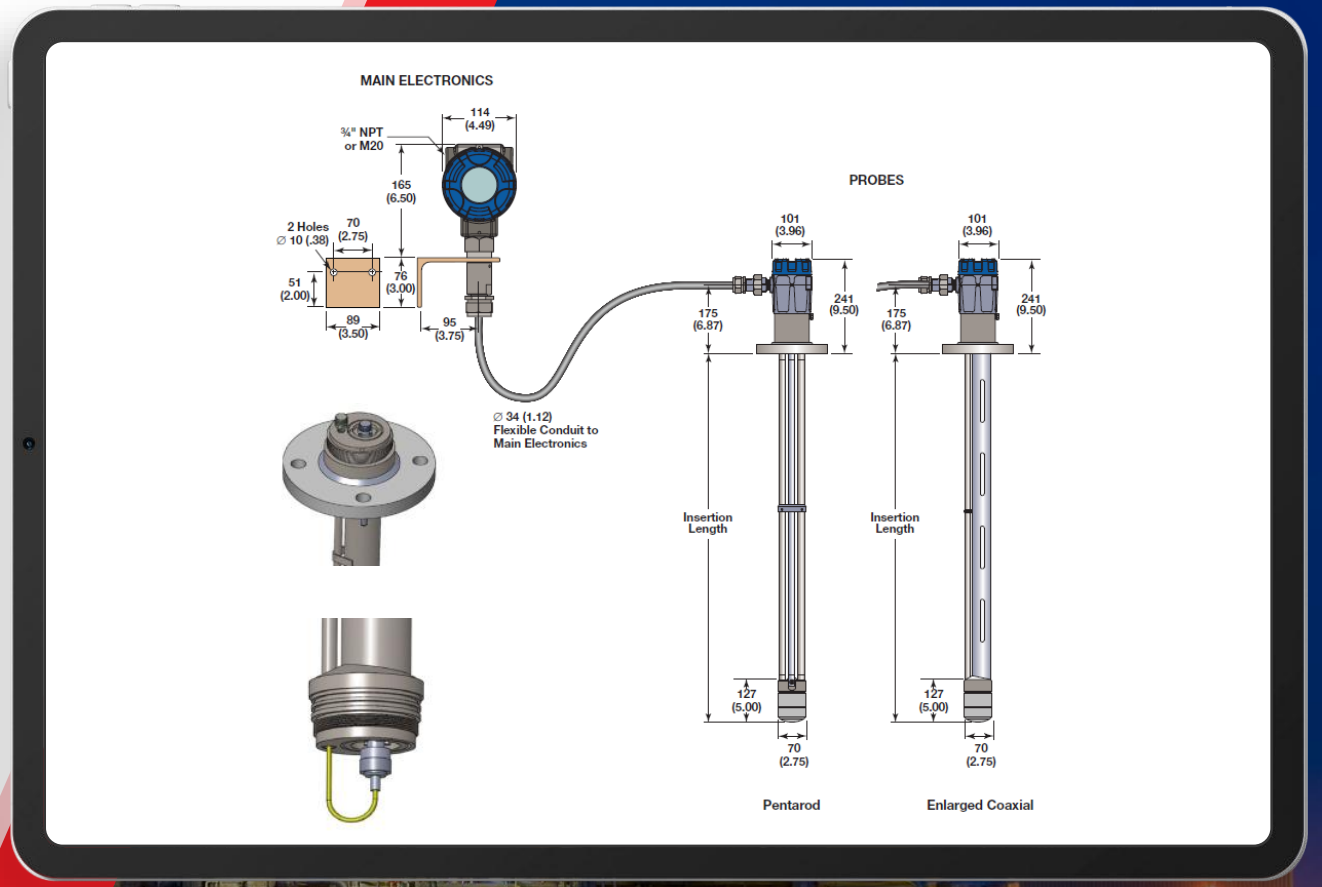
- Main Electronics
- Probe Electronics
- Probe
- Communications Cable

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

SYSTEM ASSEMBLY
MAIN ELECTRONICS / PROBE

FOUR MAIN COMPONENTS

- Main Electronics
- Probe Electronics
- Probe
- Communications Cable



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR

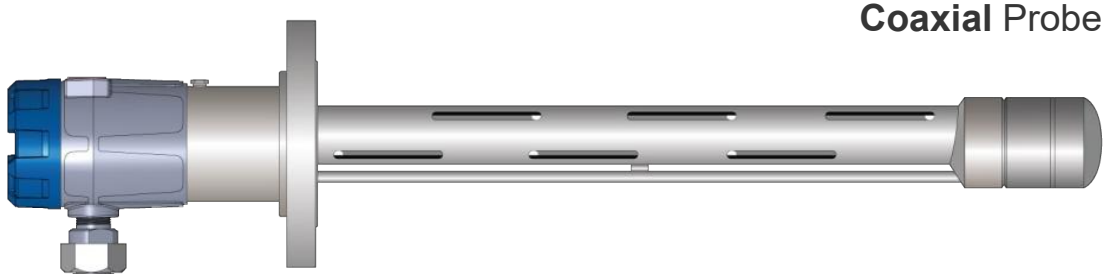
3”/Sch
80 minimum
process connection

2.90” (7.3 cm)

1000 psi (70 Bar)

400F (200C)

Coaxial Probe



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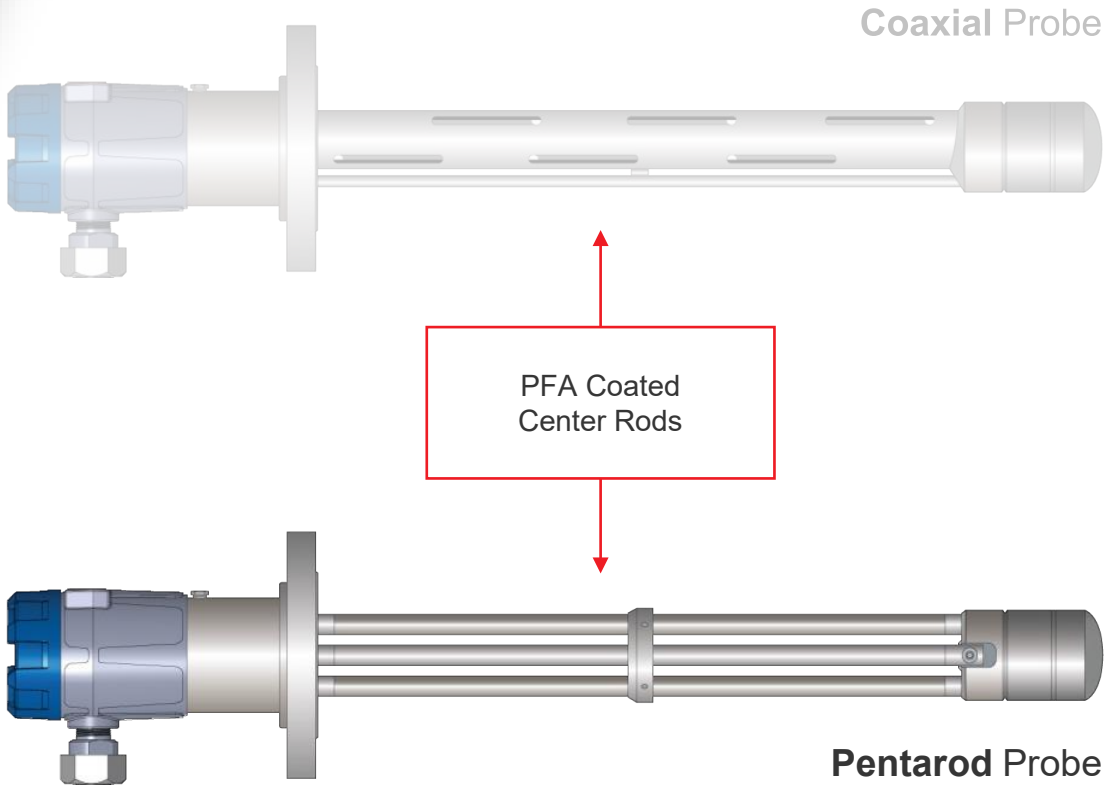


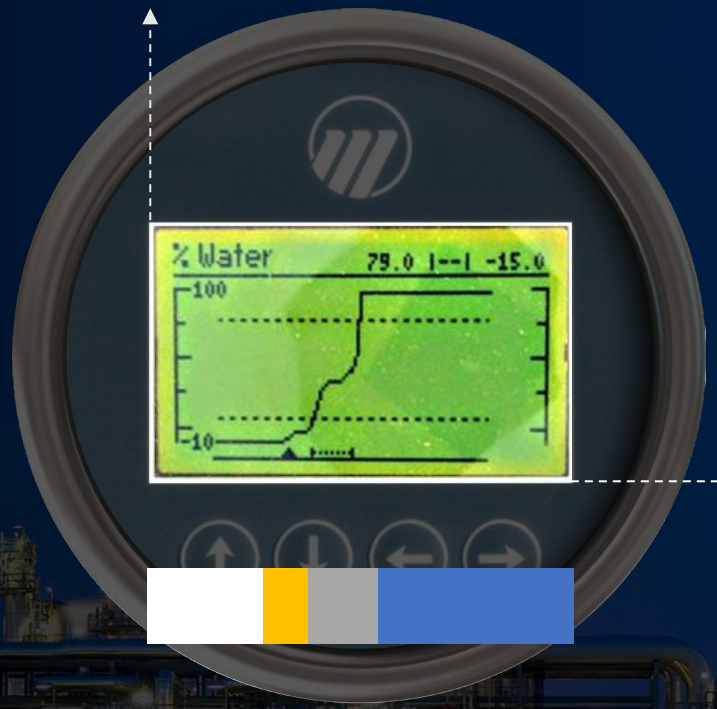
AMETEK®
LEVEL MEASUREMENT
SOLUTIONS

MULTIPLE ECHO CURVES AVAILABLE

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

WAVEFORMS

Y Axis
% water content

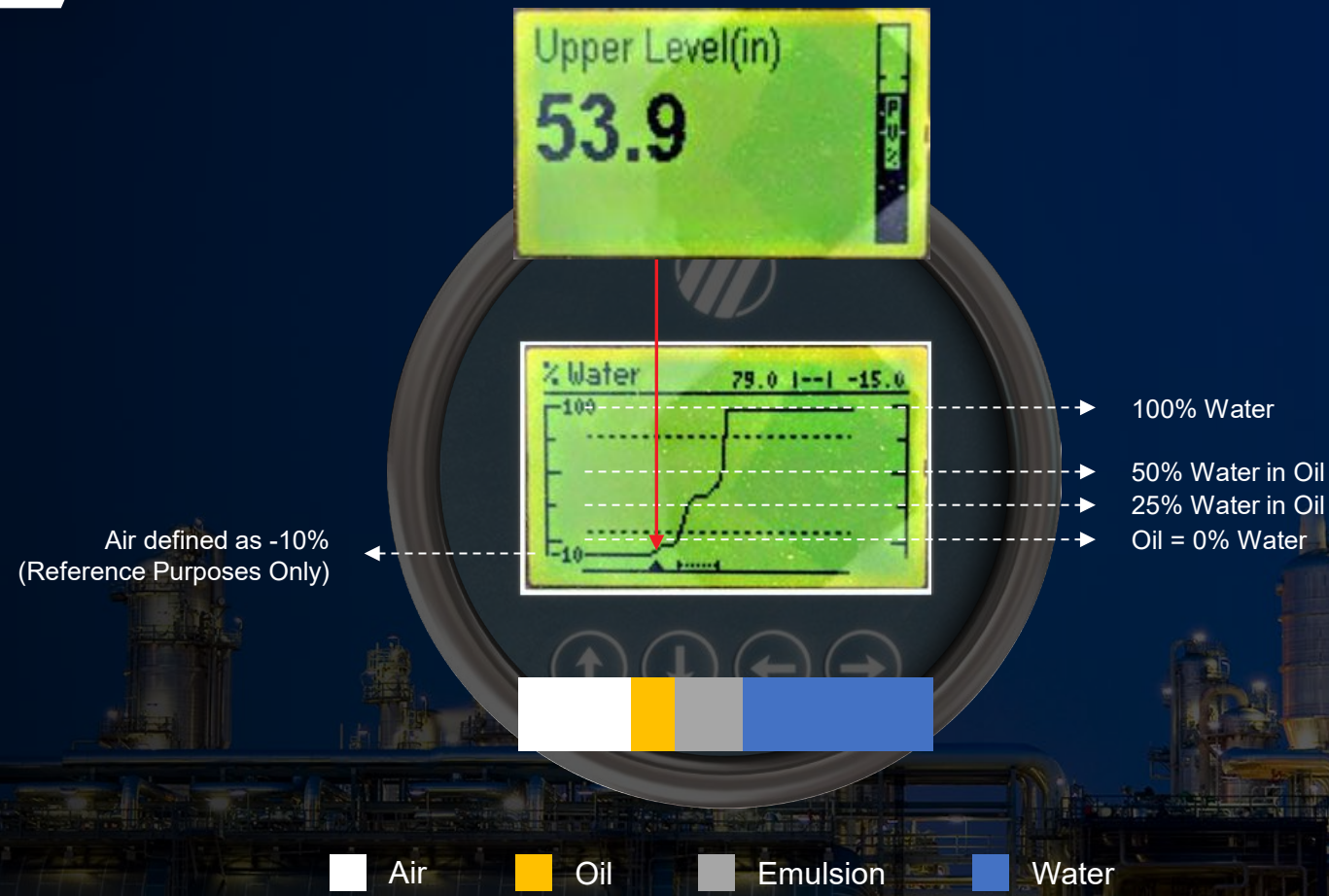


X Axis
Looking from top of probe down (left to right)

Air Oil Emulsion Water

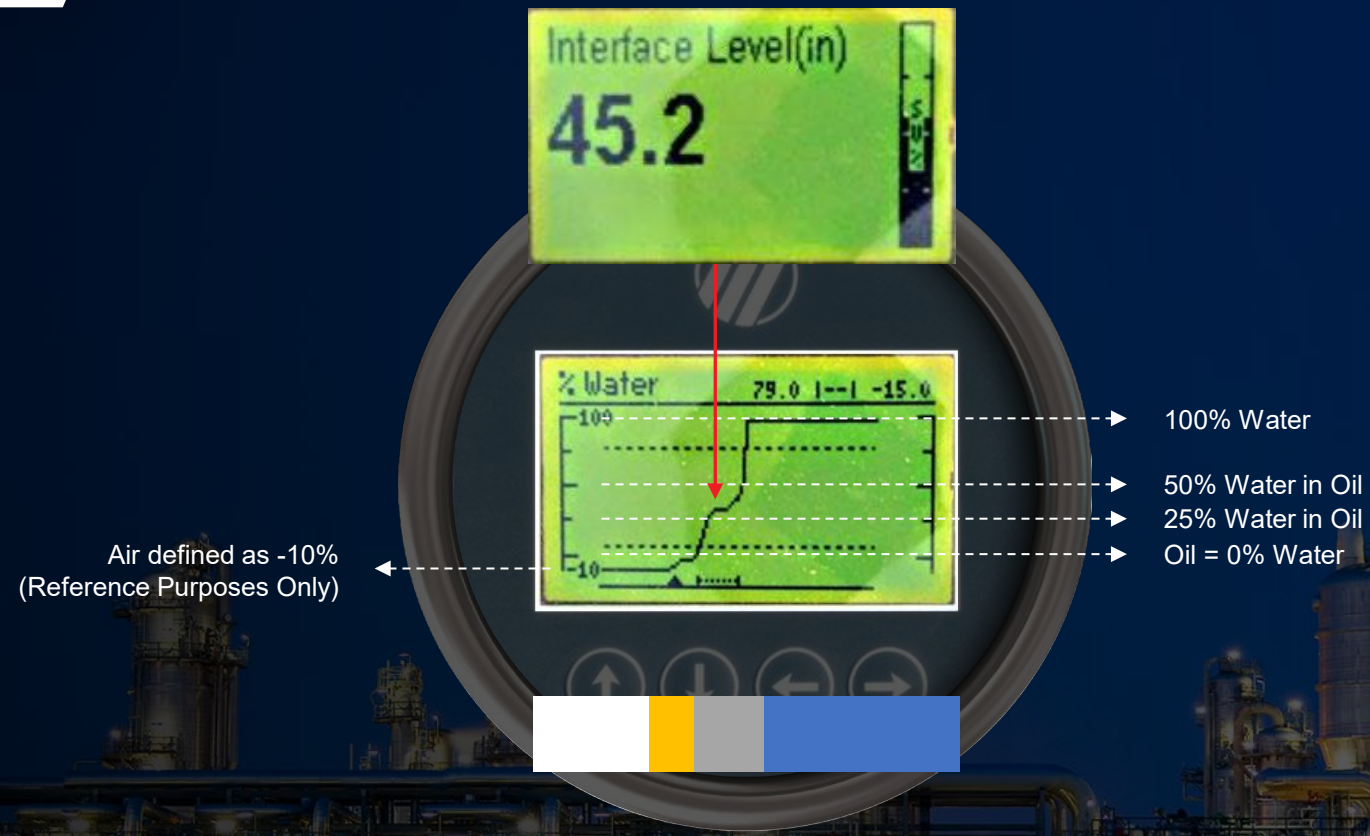
AMETEK®
LEVEL MEASUREMENT SOLUTIONS

WAVEFORMS



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

WAVEFORMS



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

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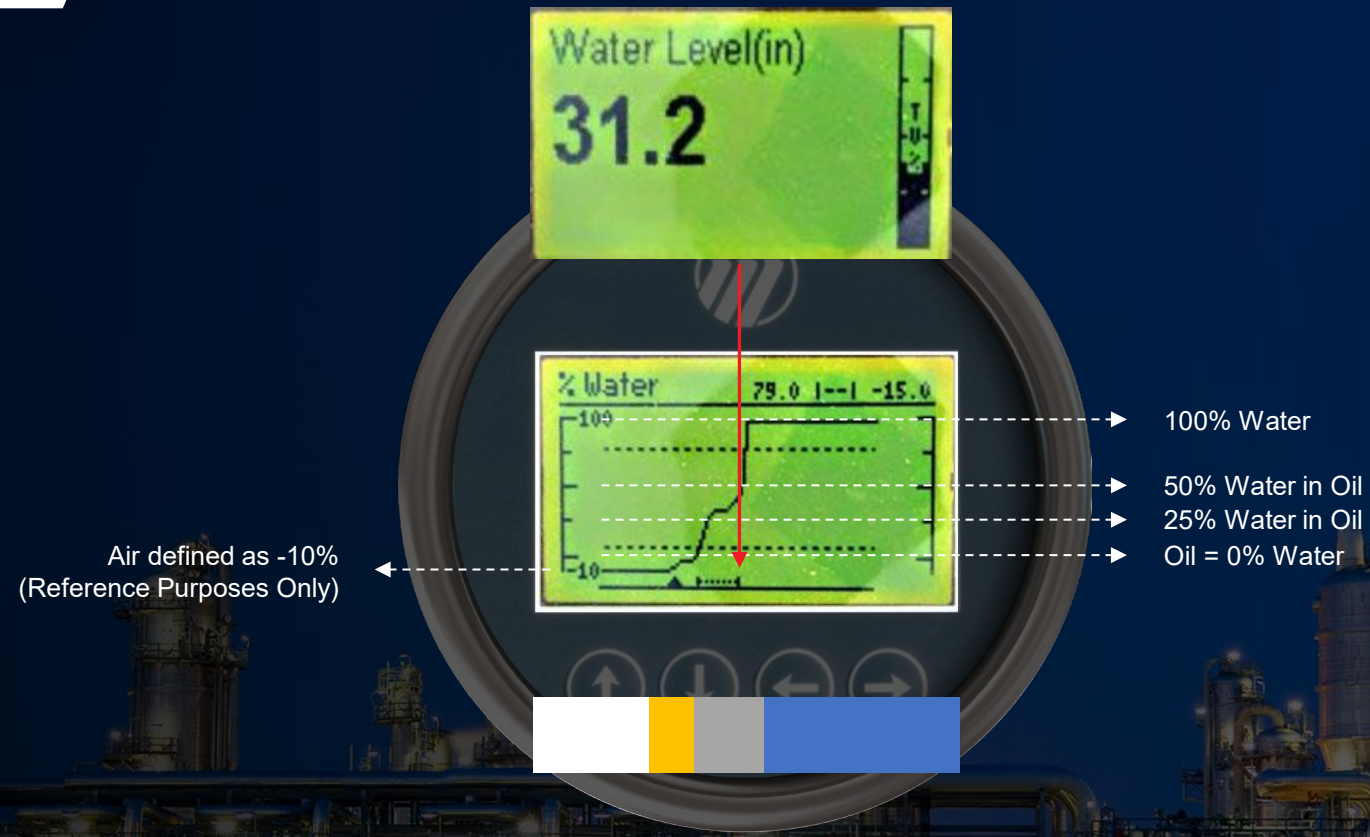
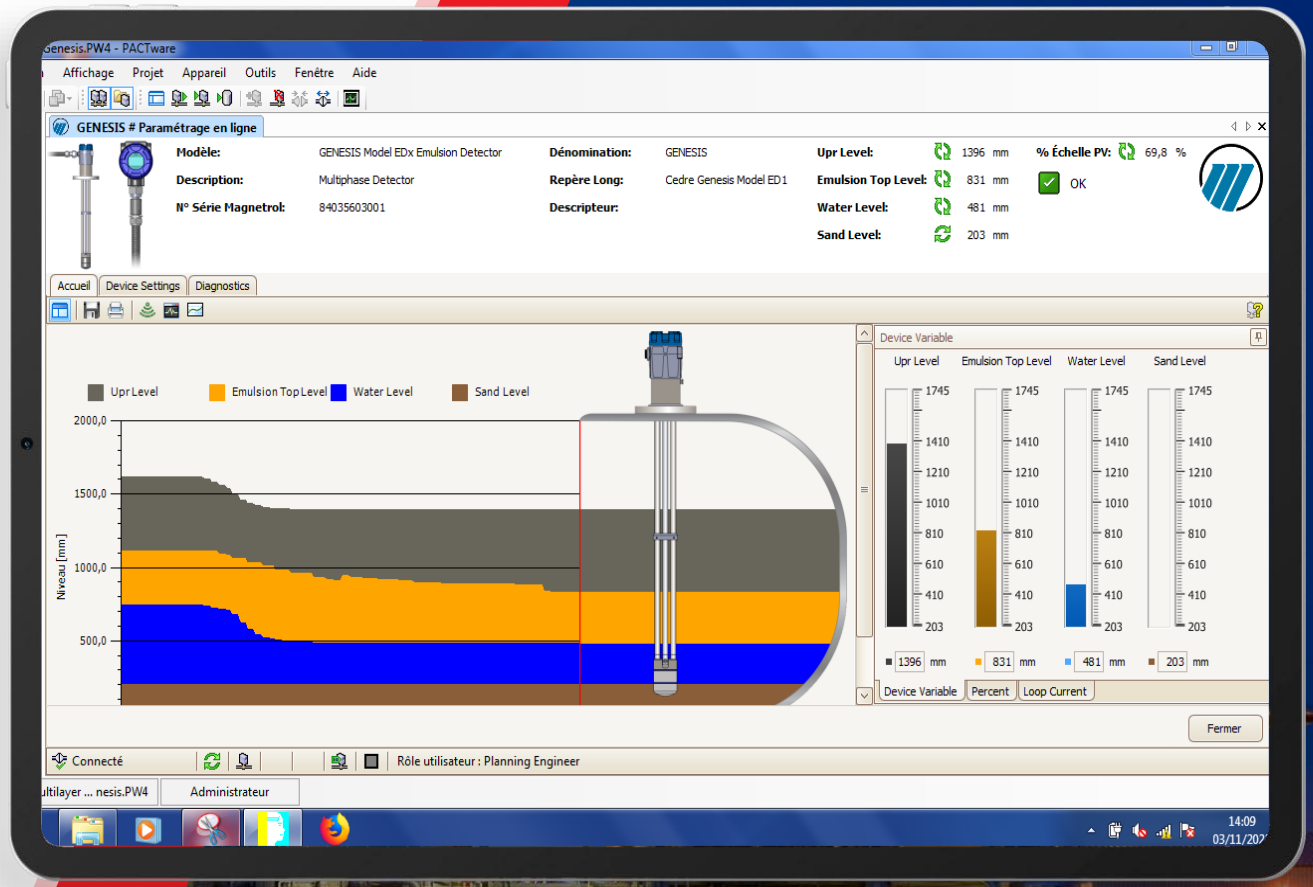


AMETEK®
LEVEL MEASUREMENT SOLUTIONS

DTM ED1
ADVANCED HOME SCREEN

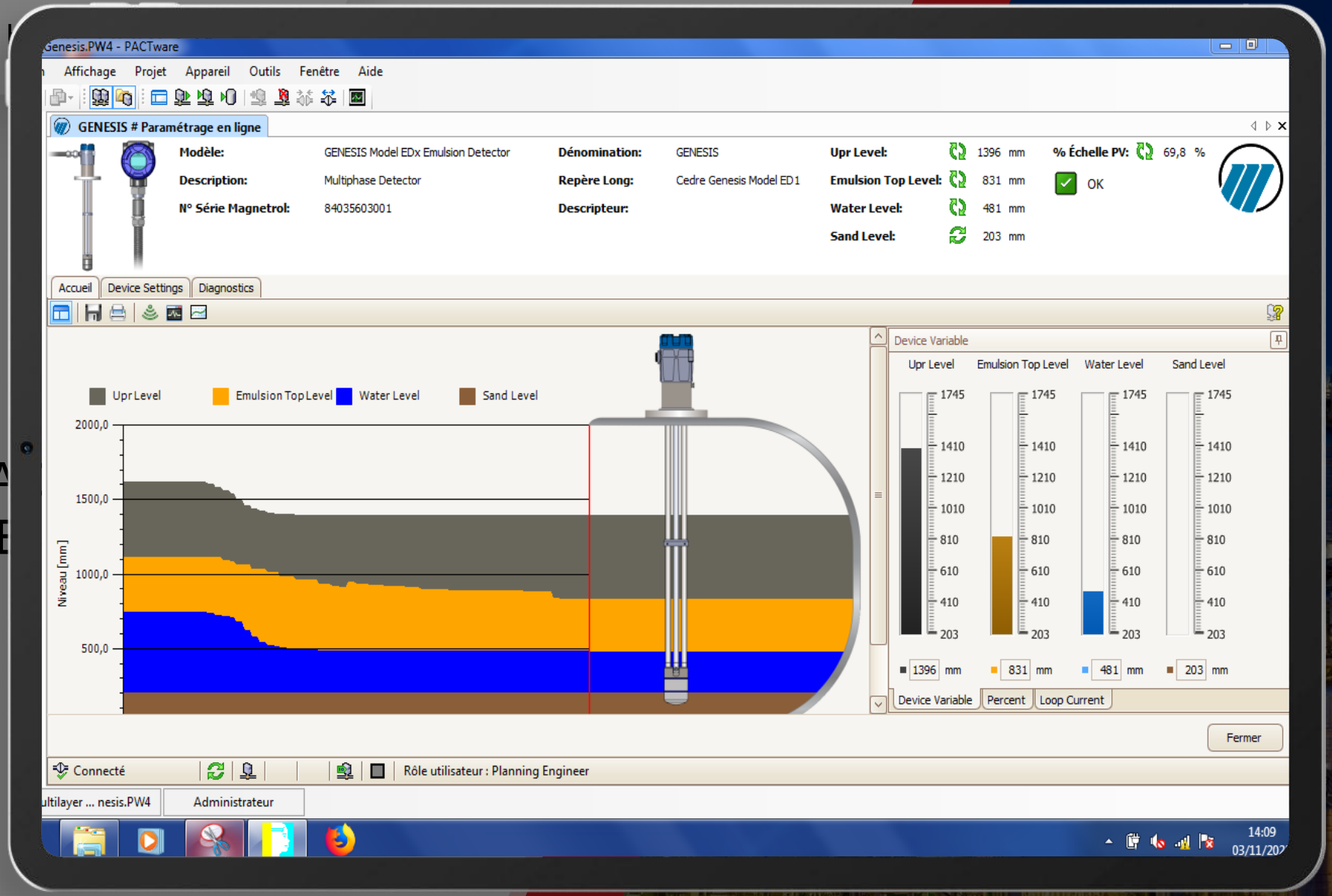
GENESIS
MULTIPHASE DETECTOR



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

DTM ED1
ADVANCED

DTM
ED1 A
HOME



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS EMULSION DETECTOR

TRANSMITTER SPECIFICATIONS
FUNCTIONAL/PHYSICAL

System Design		
Measurement Principle		TDR based electronics combined with patented, proprietary software algorithm
Input		
Measured Variable		Level, as determined by time of flight
Span		60 centimeters to 6 meters (2 to 20 feet)
Output		
Type		Four (4) 4–20 mA analog outputs, one (1) with HART;
		3.8–20.5 mA useable (per NAMUR NE43)
Resolution	Analog:	.003 mA
	Digital Display:	1 mm
Diagnostic Alarm		Selectable: 3.6 mA, 22 mA (meets requirements of NAMUR NE 43), or HOLD last output
Diagnostic Indication		Meets requirements of NAMUR NE107
Damping		Adjustable 0–30 seconds
User Interface		
Keypad		4-button menu-driven data entry
Display		Graphic liquid crystal display
Digital Communication/Systems		HART Version 7—with Field Communicator, AMS, or FDI
		DTM (PACT*ware*™), EDDL
Menu Languages	LCD:	English
	HART DD:	English
Power (at wiring board terminals)		Explosion-proof with Instrinsically Safe probe
		24 VDC (±10%), 10 Watt maximum), Um ≤ 30V DC (SELV)

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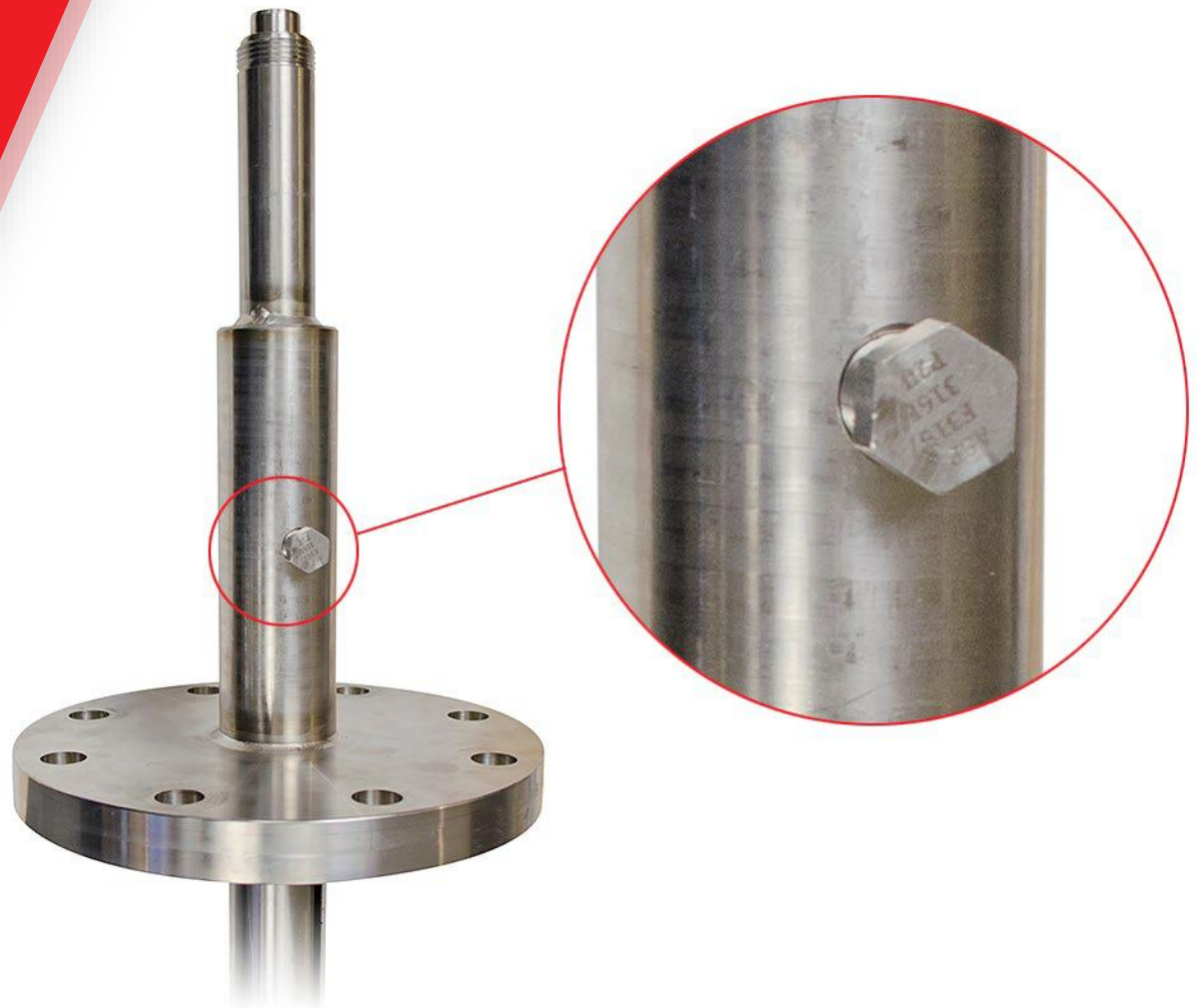
IN-SITU CLEANING
COAXIAL PROBE

Flushing port operation on Coaxial Probe is similar to **existing GWR probes**



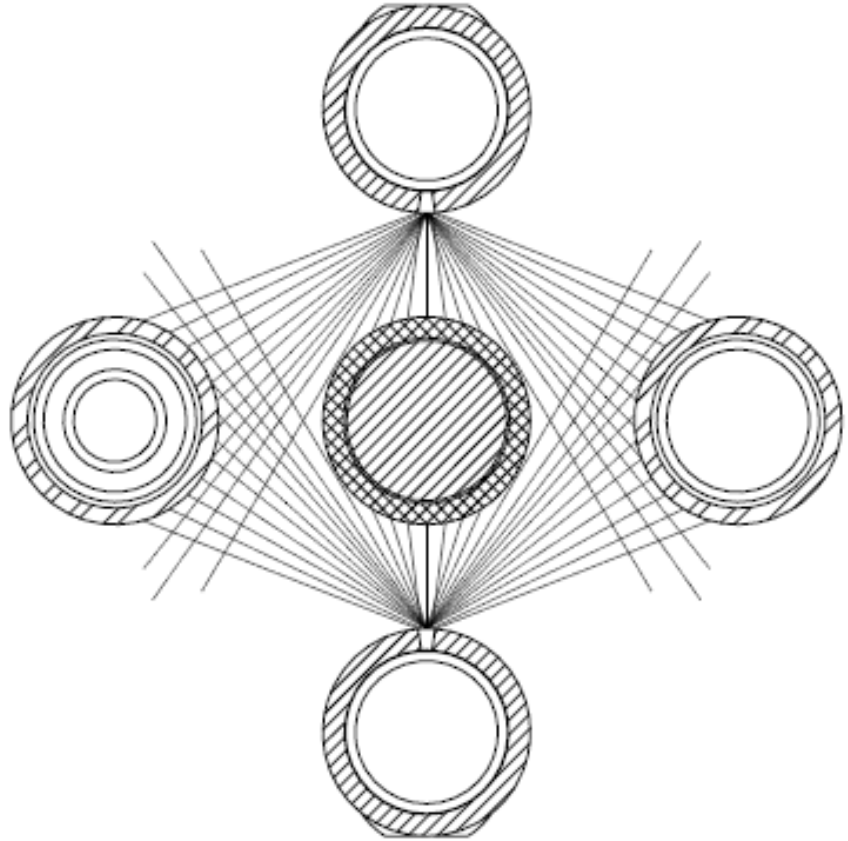
AMETEK®
LEVEL MEASUREMENT SOLUTIONS

IN-SITU CLEANING
PENTAROD PROBE

Flushing port for the Pentarod probe utilizes a cleaning system for periodic maintenance

01 Optional slots are placed to direct water onto and around the PFA coated center rod

02 Guidelines, available upon request



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AMETEK®
LEVEL MEASUREMENT SOLUTIONS

FIELD
TESTING

GENESIS
MULTIPHASE DETECTOR

- **Lab** Testing
- **3rd Party** Testing
- **Field Beta** Testing
- **Customer** Installations

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

LAB
TESTING

GENESIS

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

3RD PARTY
TESTING

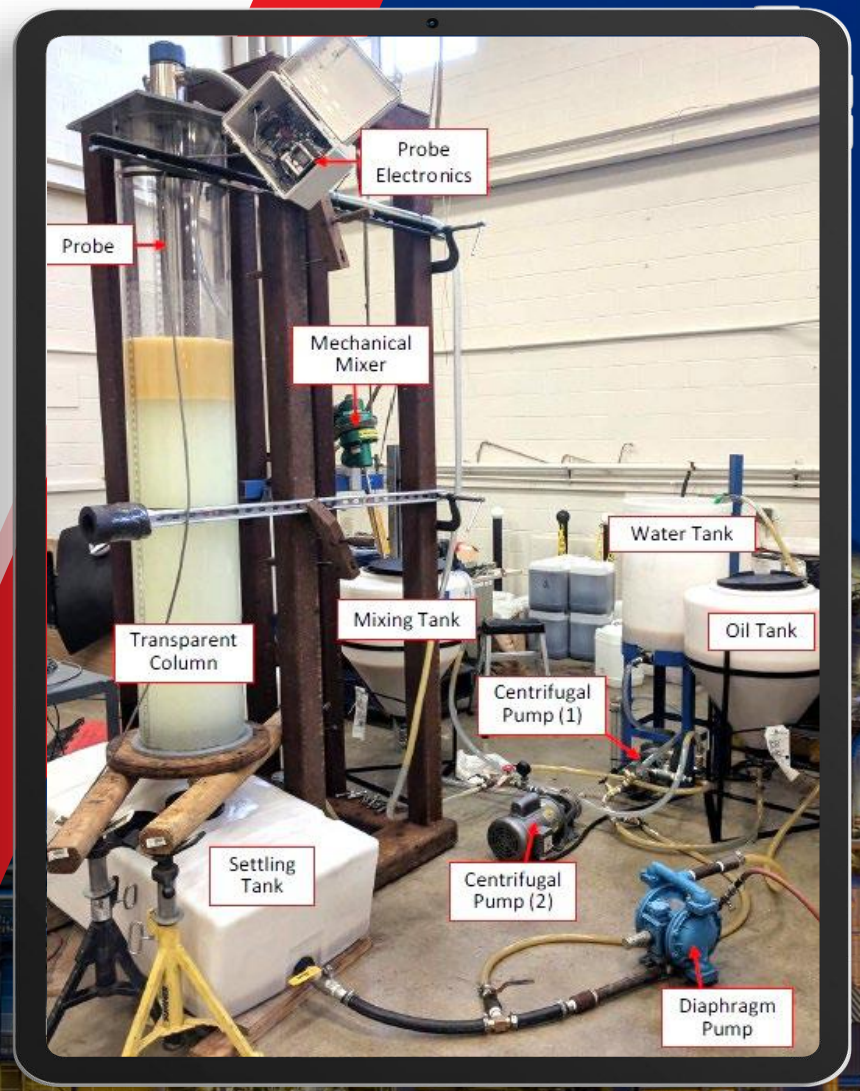
GENESIS
EXTERNAL LAB TESTING

Southwest Research Institute
(San Antonio, Tx)

26 different tests over the course of two days :

01 4 different hydrocarbons with different viscosities

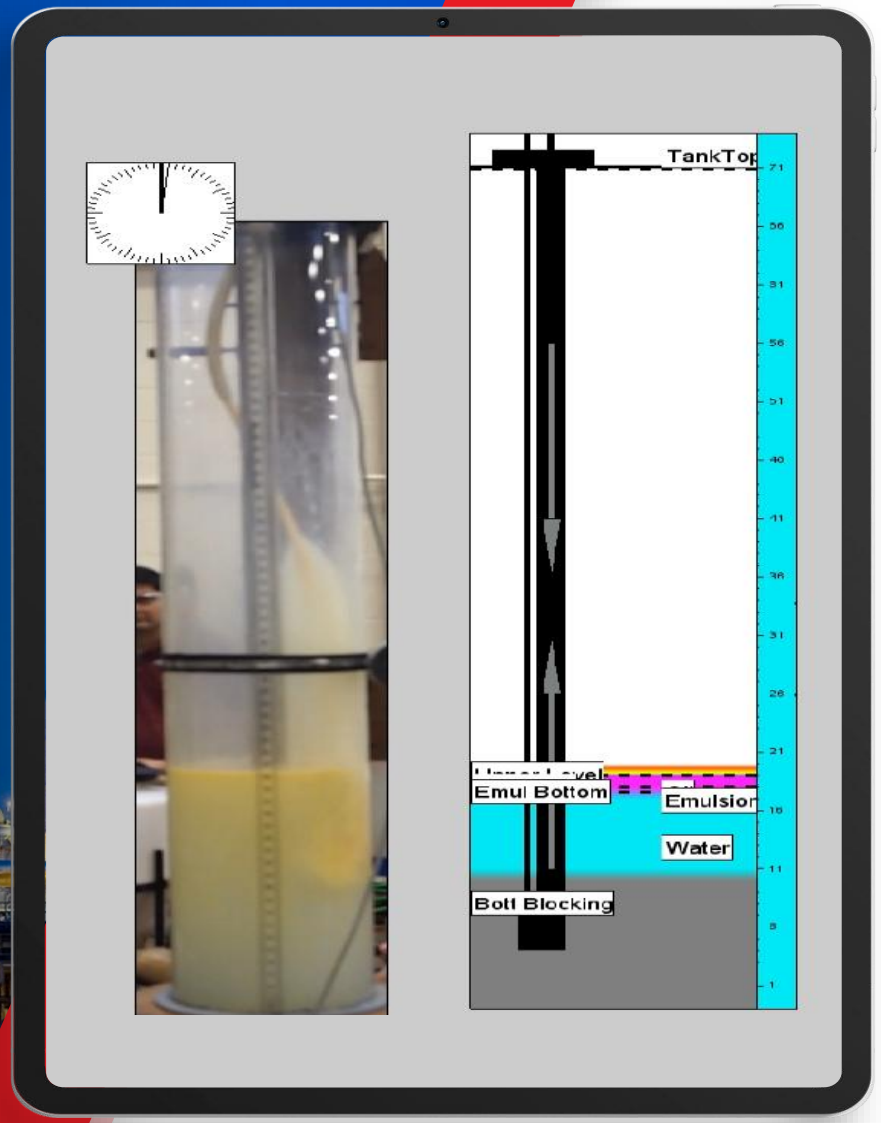
02 Combinations of tap water and salt water

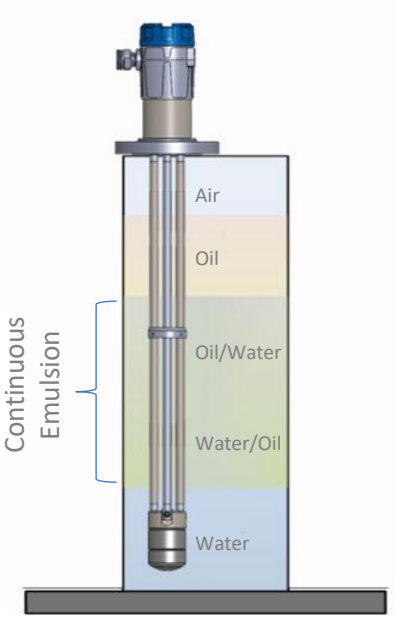


AMETEK®
LEVEL MEASUREMENT SOLUTIONS

VISUAL REPRESENTATION
OF LEVELS @SwRI

GENESIS
MULTIPHASE
DETECTOR



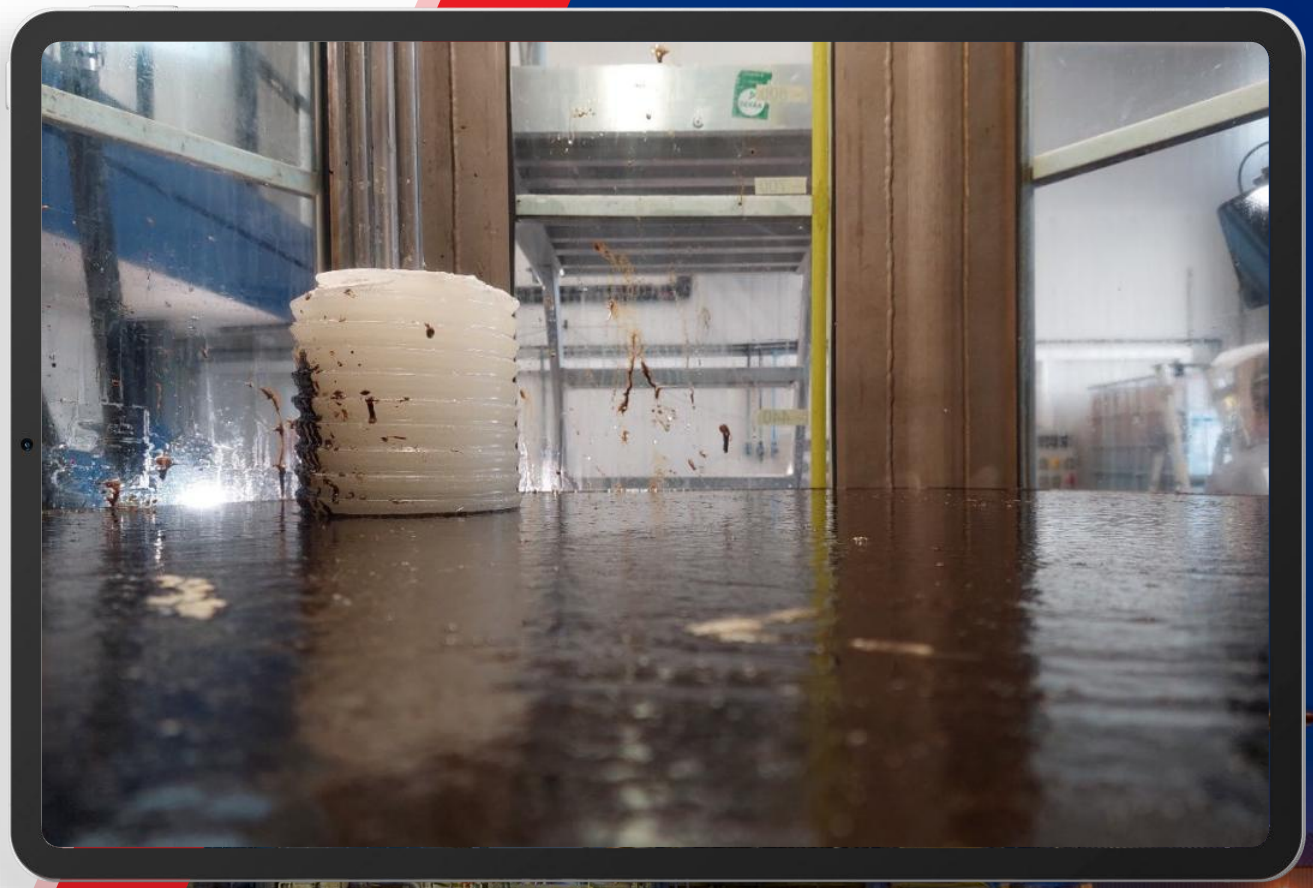


AMETEK®
LEVEL MEASUREMENT
SOLUTIONS

GENESIS
3rd PARTY TESTING

3rd Party Testing at Cedre in Brest, France
for a major international oil producer

Cedre



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LEVEL MEASUREMENT SOLUTIONS

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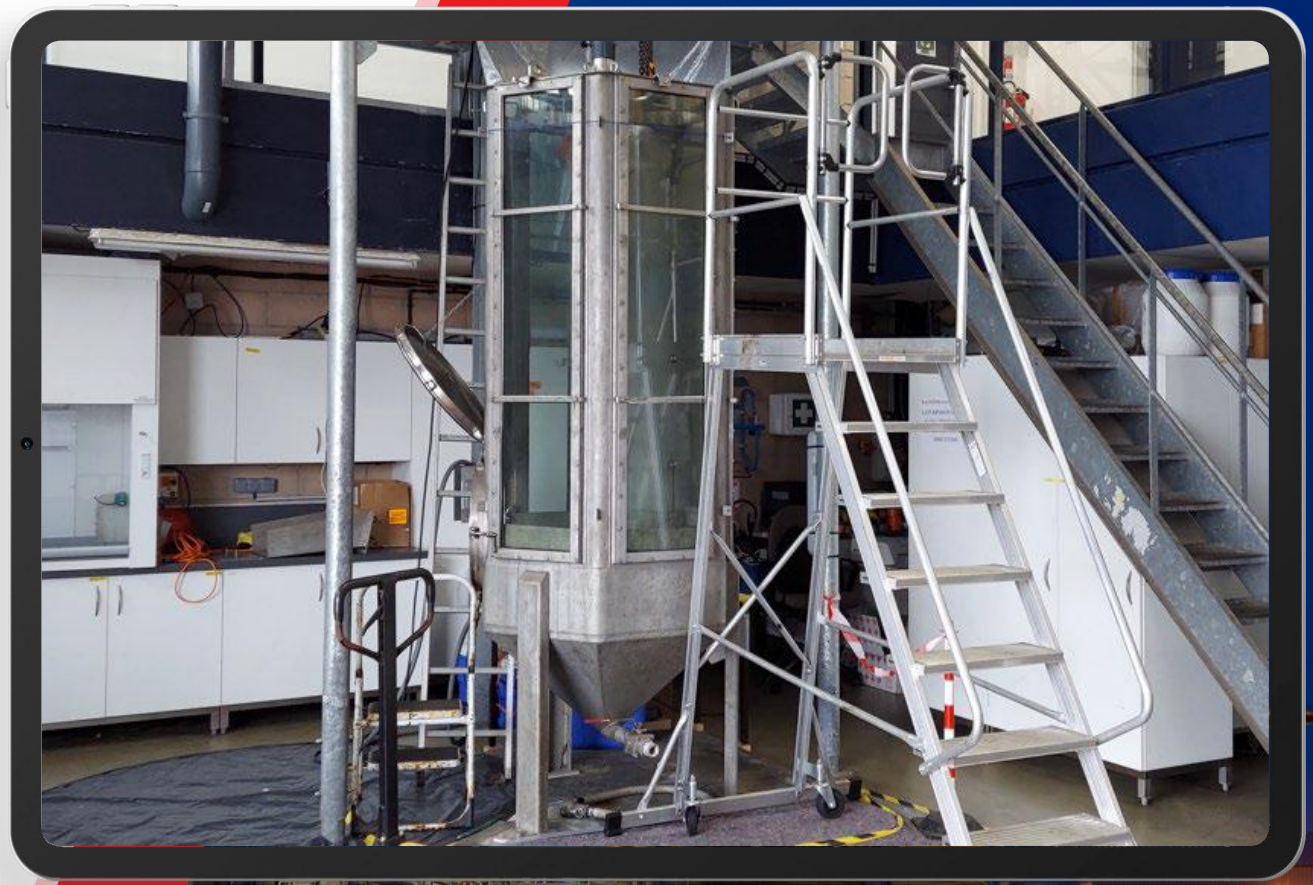

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

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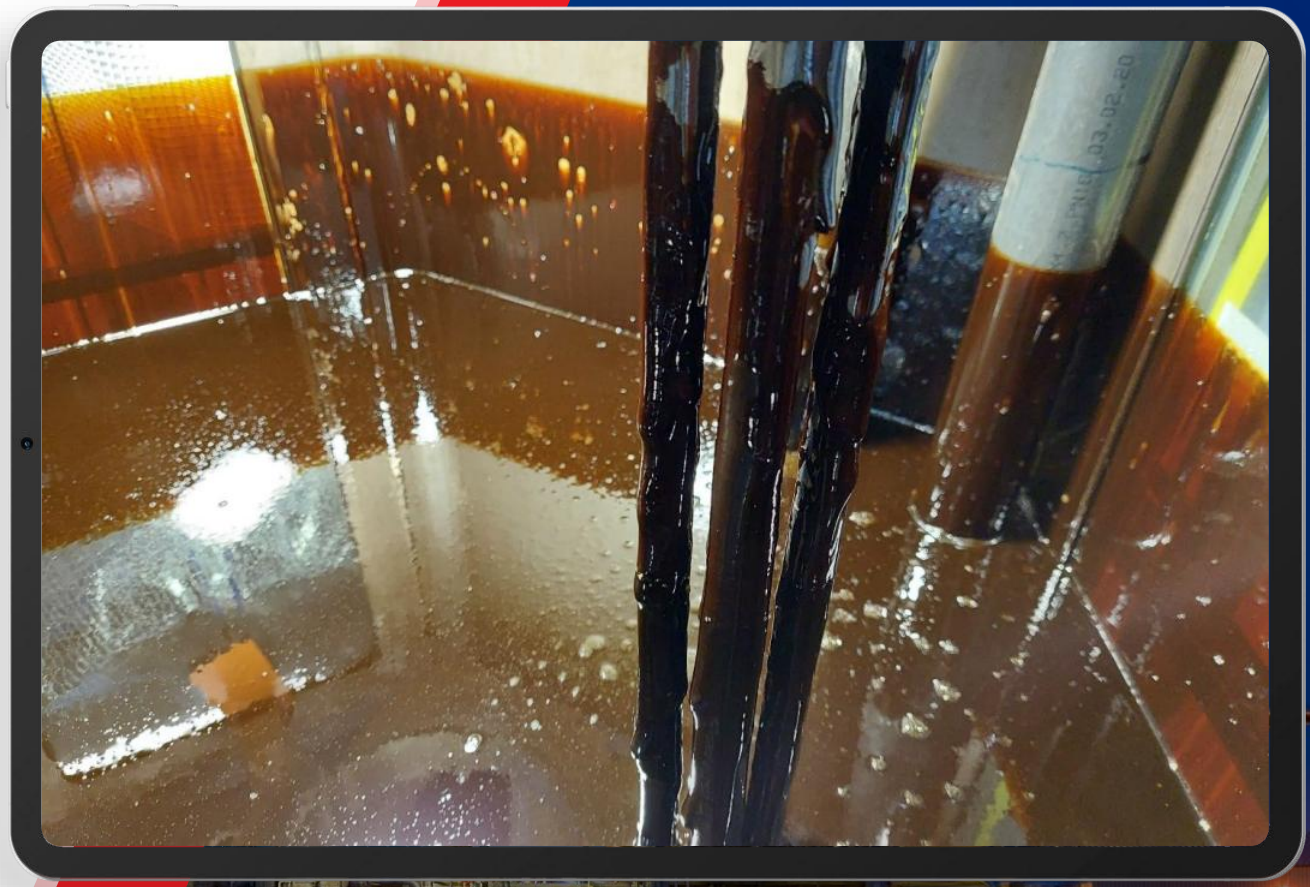

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
3rd PARTY TESTING

3rd Party Testing at Cedre in Brest, France
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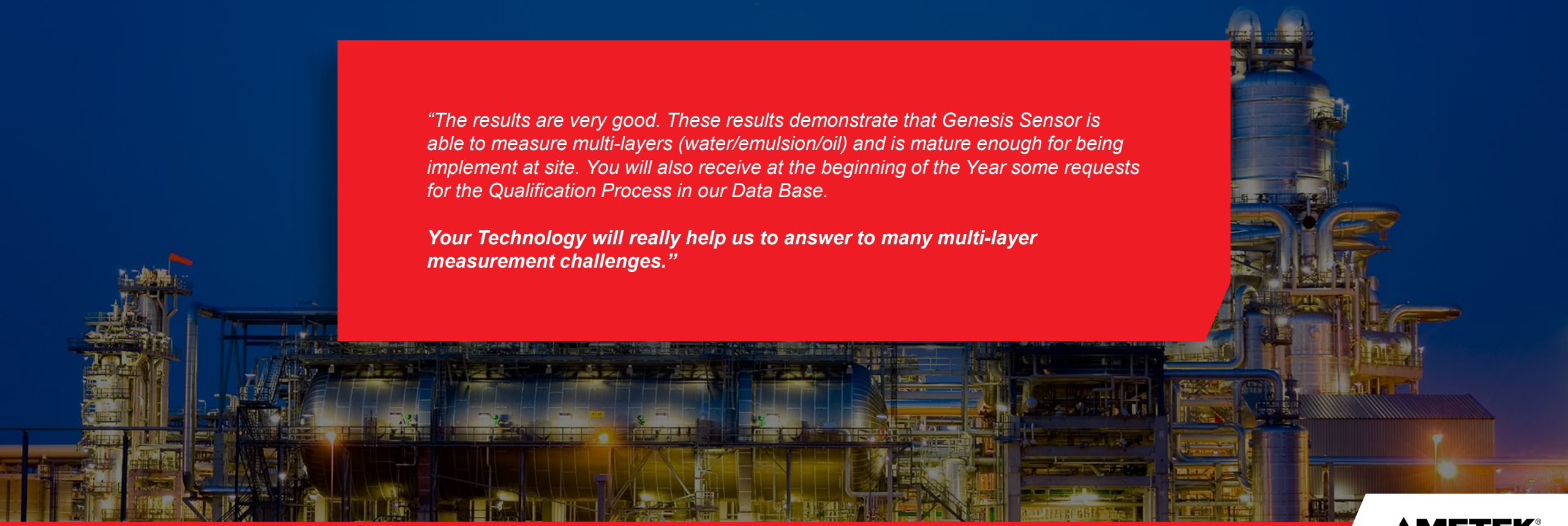
AMETEK®
LEVEL MEASUREMENT SOLUTIONS

CUSTOMER COMMENTS

"The results are very good. These results demonstrate that Genesis Sensor is able to measure multi-layers (water/emulsion/oil) and is mature enough for being implement at site. You will also receive at the beginning of the Year some requests for the Qualification Process in our Data Base.

Your Technology will really help us to answer to many multi-layer measurement challenges."



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

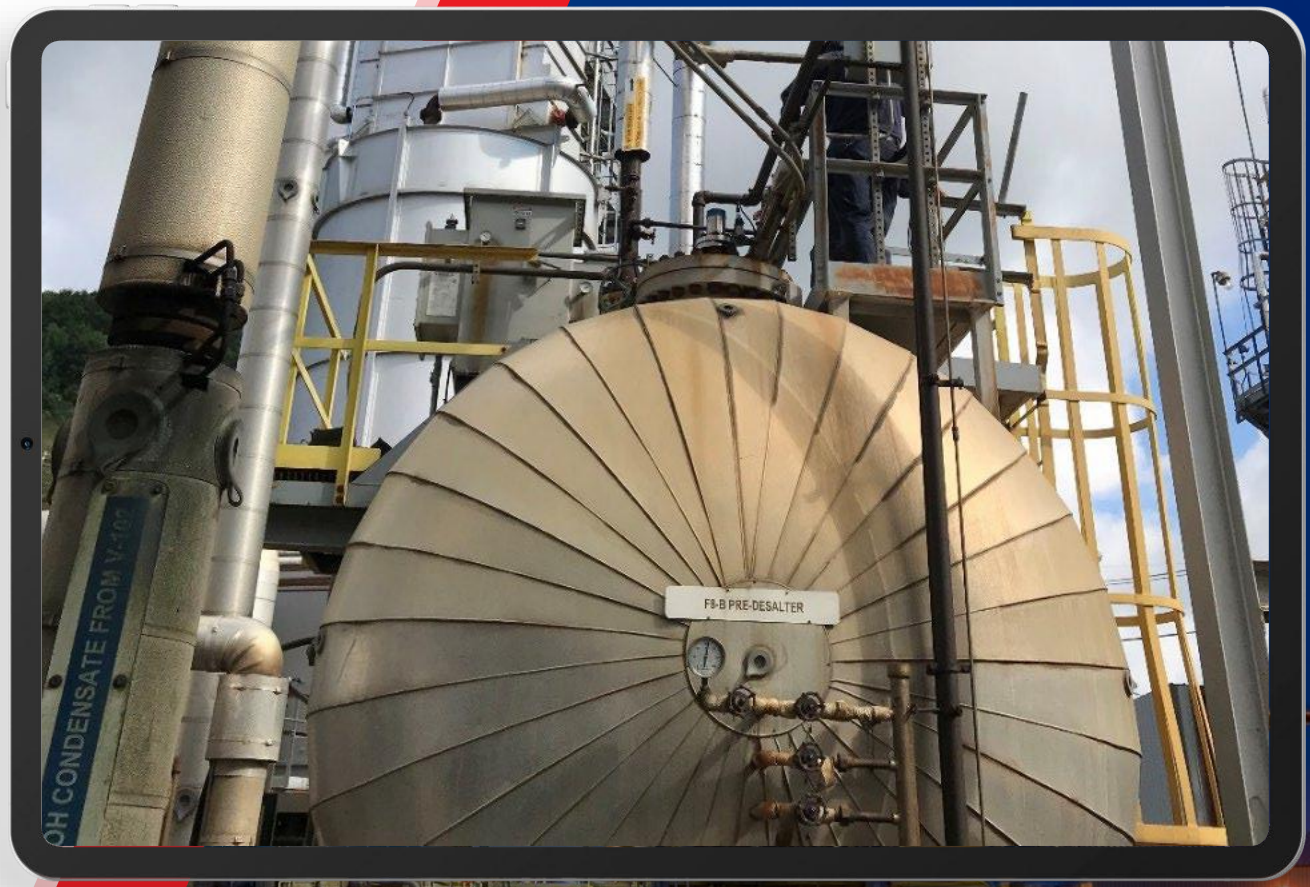
GENESIS
MULTIPHASE DETECTOR

Refinery
(Eastern USA)

13-foot (4-meter) desalter

01 **Torque Tube**
installed

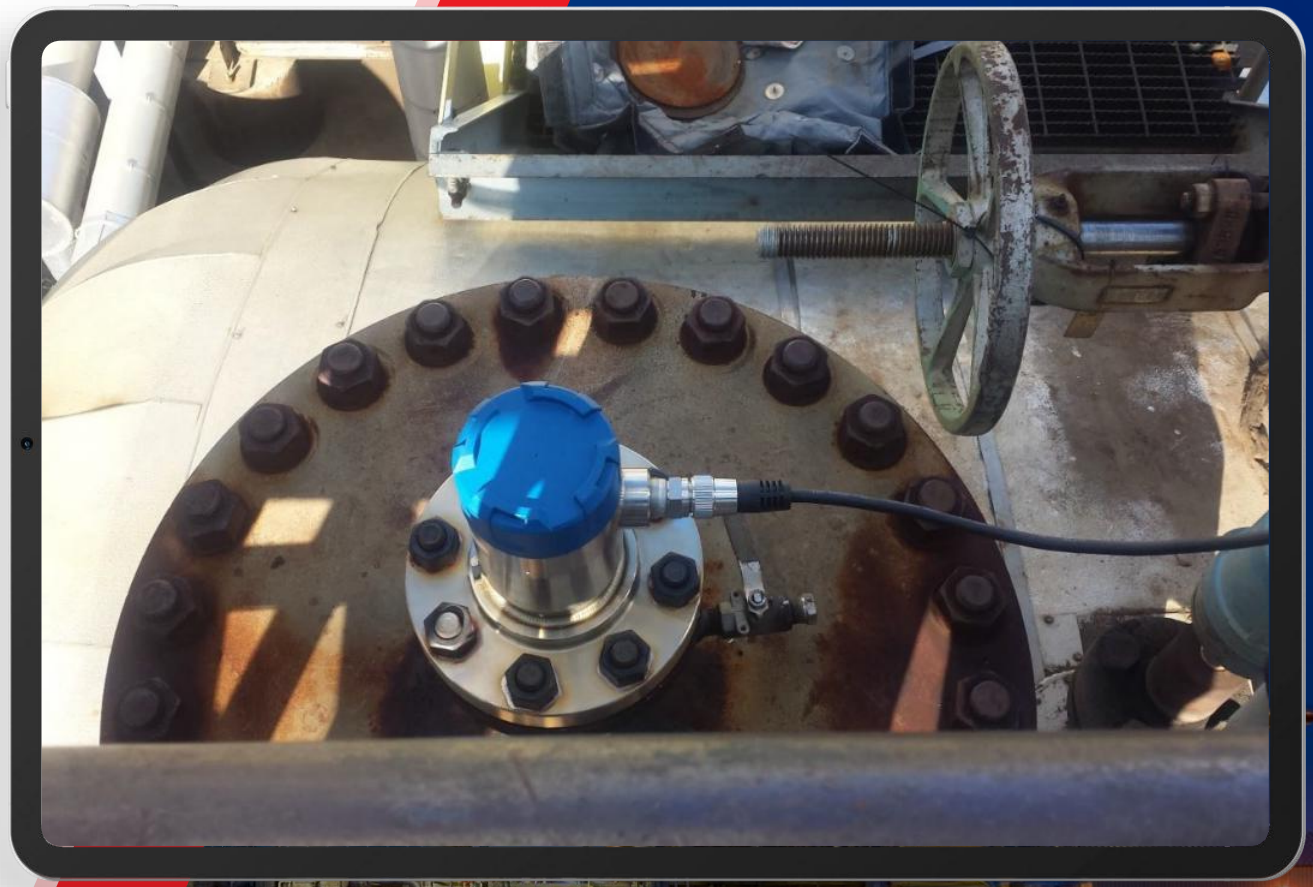
02 **Side taps**
used as reference



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

BETA
EXAMPLE

GENESIS
TEST INSTALLATION



Our 3”/300 lb. ANSI flange is mounted on an existing flange

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR

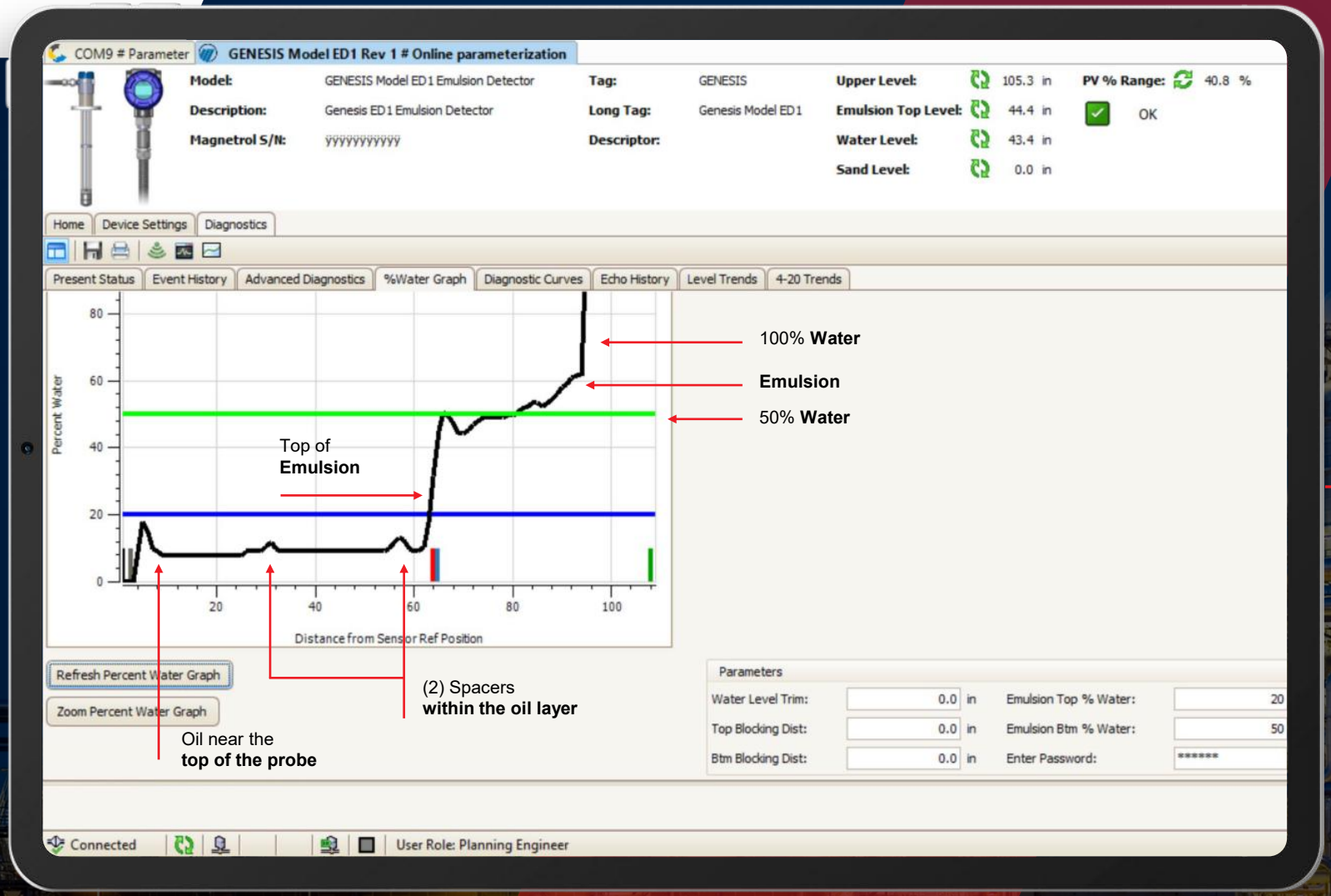
2nd Tap

3rd Tap

4th Tap

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

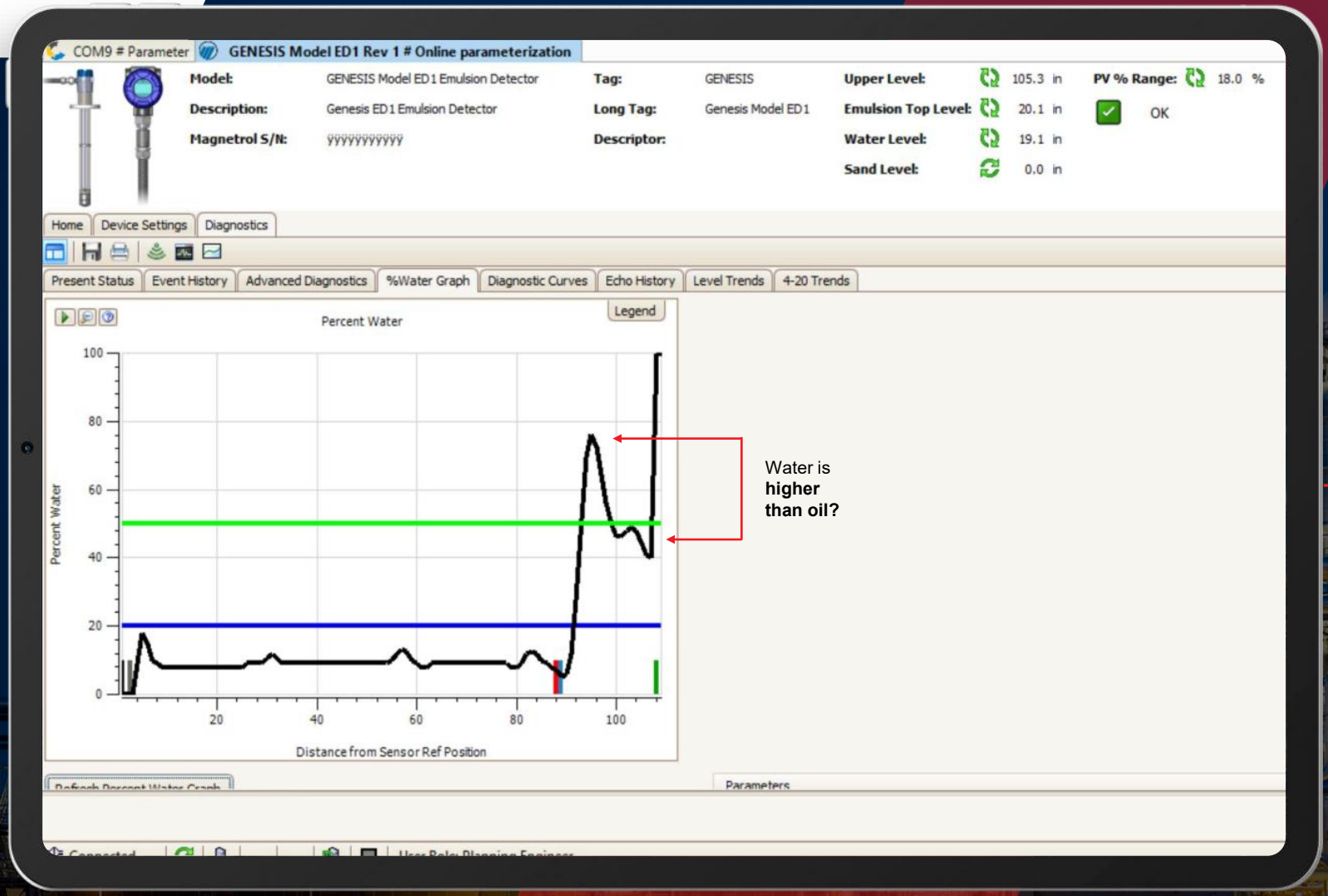
BETA
EXAMPLE



9:45 am

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

BETA
EXAMPLE

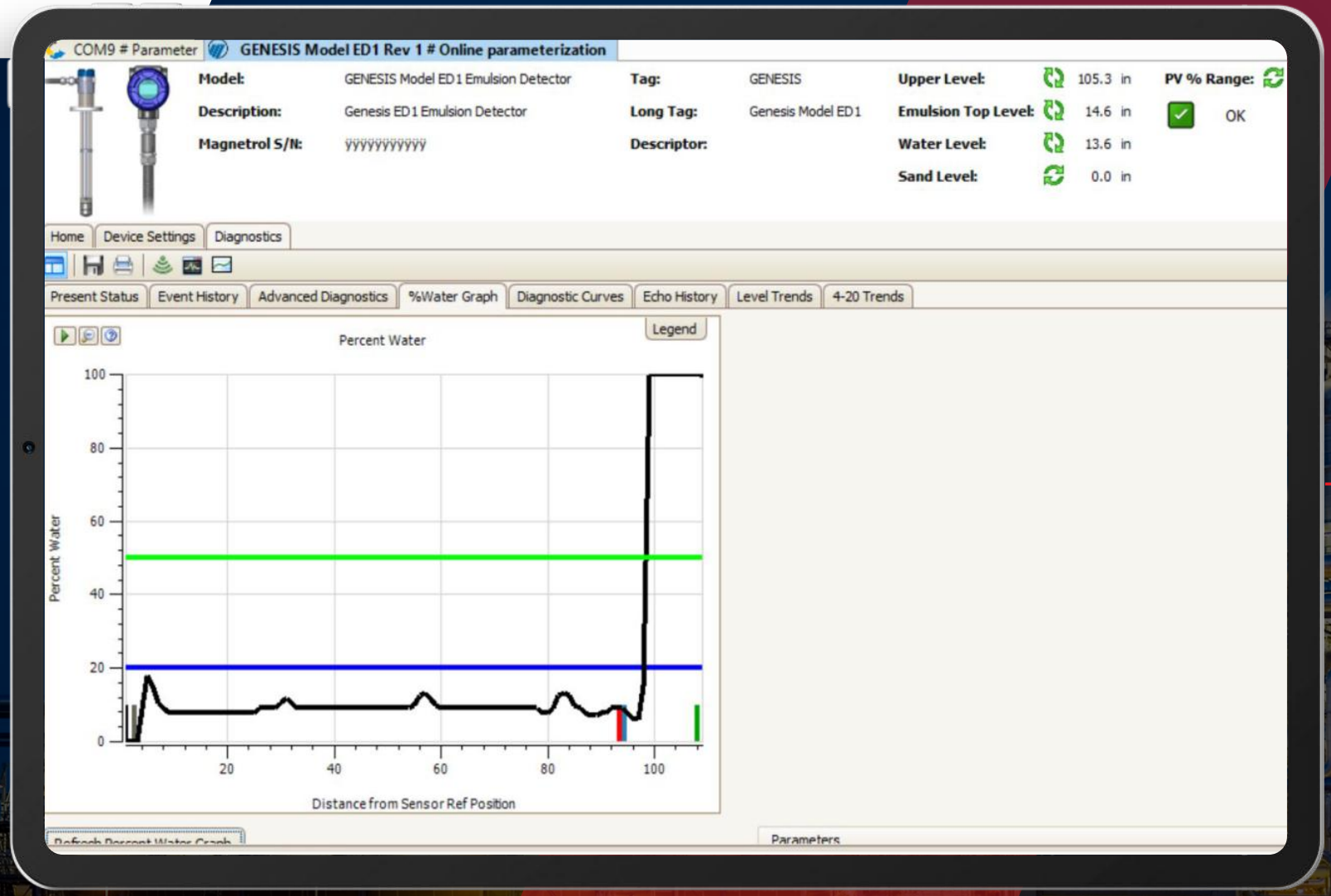


Water is **higher than oil?**

1:10 pm

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

BETA
EXAMPLE



1:45 pm

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
CUSTOMER COMMENTS

"Not having to clean the vessel and displacer at this time will save us thousands of dollars and save manpower for other work."

"The feedback we have received from our chemical company is it is the best the desalter has looked in a long time."

"We are currently averaging between 50-100 barrels a day of water in the crude. If we cut that in half that could be a savings of $2500 - $5000 a day!"


GENESIS™
MODELS ED1 & ED2
Multiphase Detector

Case Study – Model ED1 Installed on Desalter at Refinery

Product Details

Model ED1-210B-310 Multiphase Detector with PEF-5400-A00-01-106 Pentarod probe

Application

A Genesis™ Multiphase Detector with a 106-inch long Pentarod probe was installed on a 13-foot diameter desalter at a refinery in the Eastern United States for monitoring and comparison vs. an existing Fisher torque tube displacer transmitter. Desalters are an important process element at refineries as desalting removes both salt and residual free water. The goal in this application is to keep the interface level constant for optimum efficiency. The challenge is that interface level must be accurate enough to control and keep free water from contacting the desalter electrodes, which can cause expensive damage.

Test Results

Commissioning was confirmed via comparison to visual samples taken from side taps with initial indications showing a torque tube error of up to 20%.

Three weeks later, an upset within the vessel was significant enough to disable the torque transmitter to the point where it would no longer read below 70% level. At one stage during the displacer malfunction, it was proven (by customer via side taps, and later by viewing the %Water Graph on the Model ED1 DTM) that there was actually water ABOVE the oil in the vessel, as described by the customer.

"At first I thought we were getting incorrect readings but after testing at the taps, the readings were correct. We actually had higher water content at higher points in the vessel compared to lower points in the vessel. Due to the displacer level not working, we have added a selector switch to use the new probe to control the level. We are now controlling our water level with the new probe! This will give us potentially another month of runtime with this vessel before we have to take it out of service for cleaning. Not having to clean the vessel and displacer at this time will save us thousands of dollars and save manpower for other work. I did not want to use the probe for control until we went through more testing but I couldn't pass up on the opportunity."

With the Model ED1 in control for three weeks:

"Everything is going well. We are still controlling the desalter with the probe. The feedback we have received from our chemical company that provides our demulsifier is very positive. She said it is the best the desalter has looked in a long time. I think that it is due to the tighter control we have been able to provide with the new probe."

MAGNETROL / AMETEK

Conclusion

These were immediate results, but over time, an even greater return may be seen in terms of reduced corrosion and fouling in downstream piping/equipment due to tighter control of the emulsion. In addition, level control was improved from 15–20% around the setpoint with the displacer down to 1–2% with the Genesis. They have benefitted by this improved control in both time (with respect to maintenance) and money (with respect to chemical additives). Next step is to install a longer probe in place of the torque tube. A longer probe resting closer to the bottoms of the vessel will allow earlier sand detection. Knowing the level of the sand will allow them to properly plan shutdowns, instead of blindly shutting down the vessel every six months for cleaning. It must be noted that not all desalters will have sand accumulation; however, many separators will indeed have sediment/sand and this device will provide enhanced visibility to all levels.

The good from the onset was to have our device control the levels in the vessel; however, it happened a little quicker than expected. A true success story with this new and exciting

Torque Tube Displacer Transmitter

Bulletin 03-210.0
Effective: May 2022

AMETEK

page 2 of 2

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

BETA
EXAMPLE

GENESIS
TEST INSTALLATION

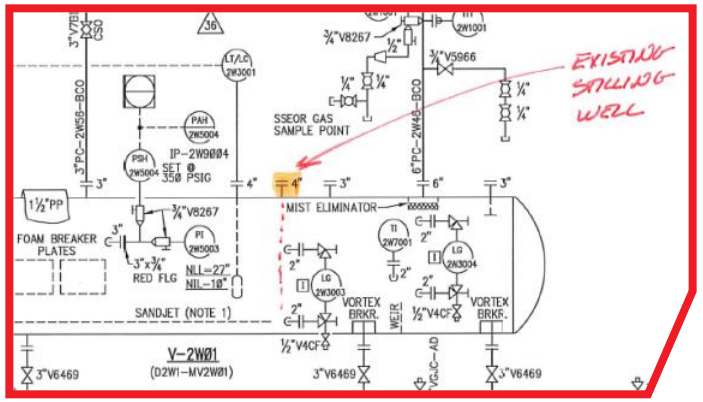
Kuparuk River Oil Field
Unit's Location in Alaska

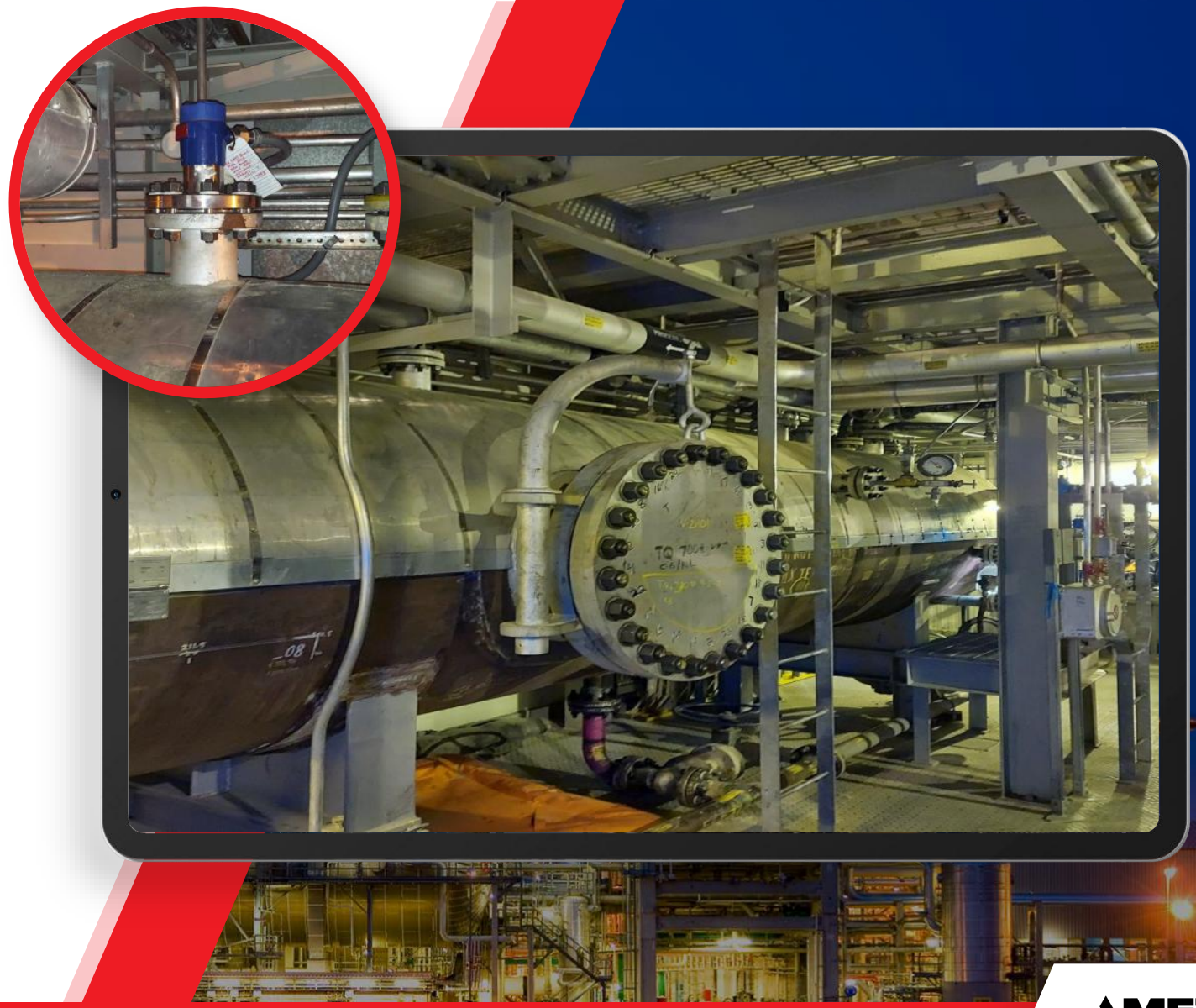
6' (2 meter) diameter Drill Site Separator

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

BETA
EXAMPLE

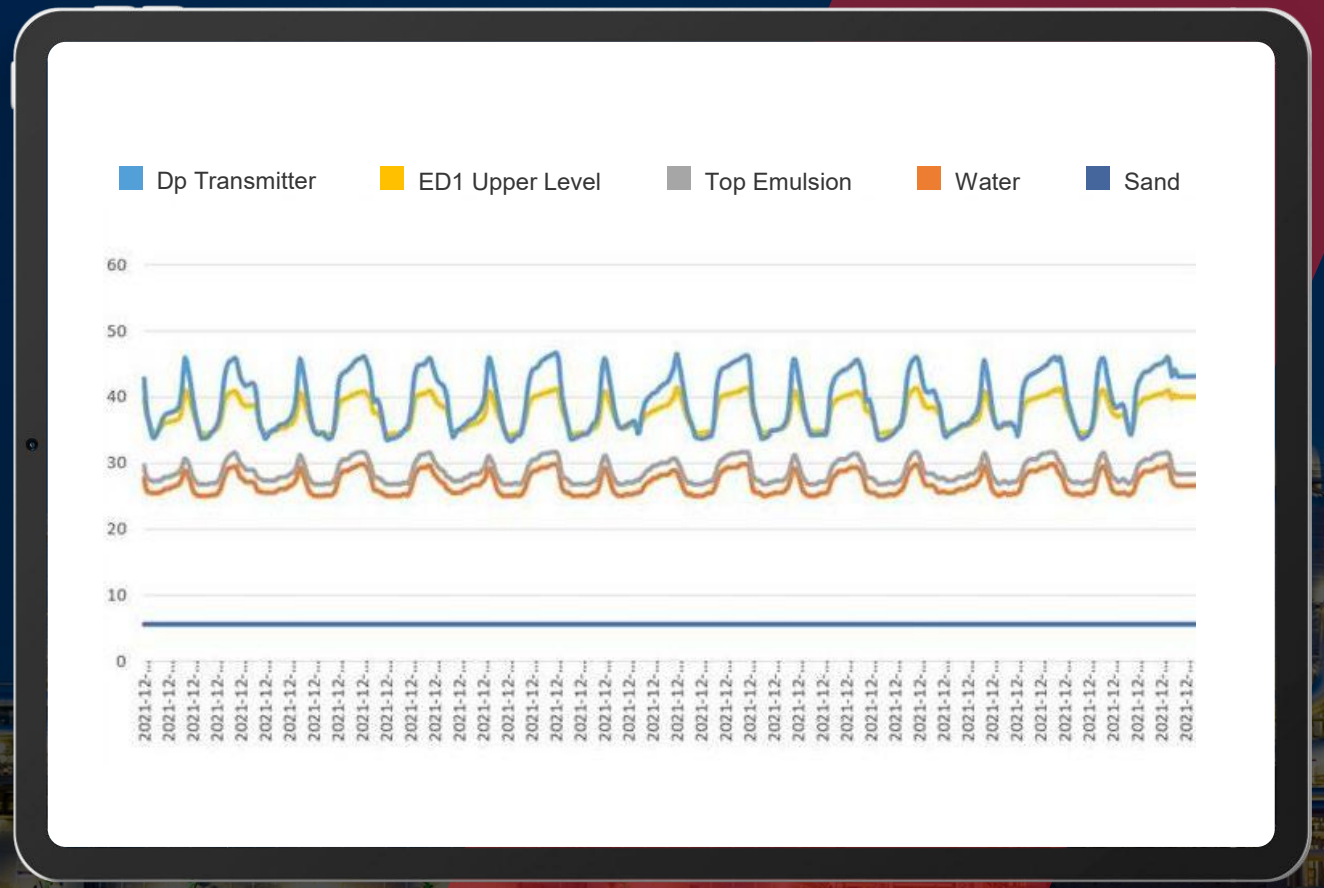
GENESIS
TEST INSTALLATION





AMETEK®
LEVEL MEASUREMENT SOLUTIONS

BETA
EXAMPLE



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

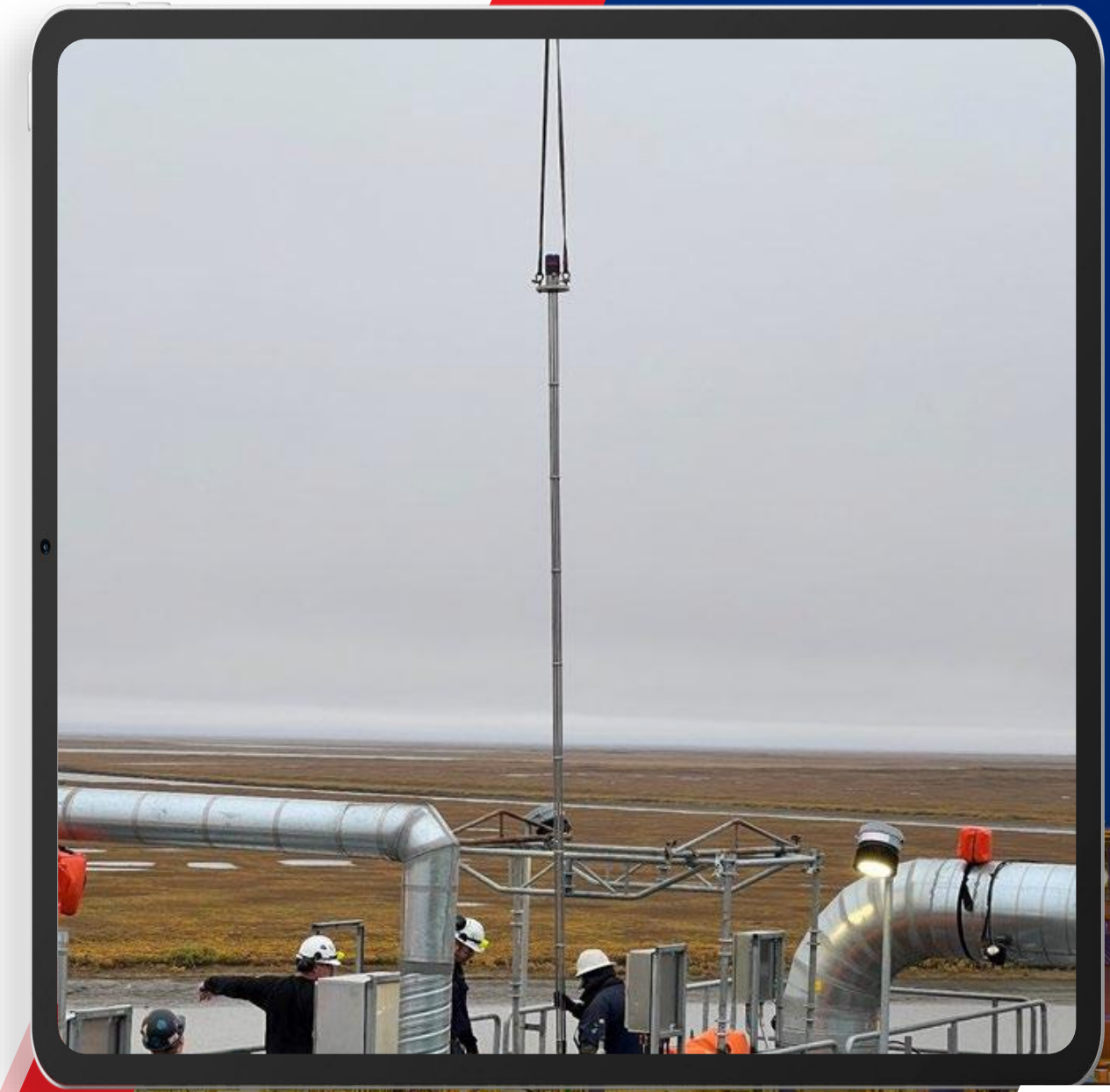
GENESIS
SLUG CATCHER

Kuparuk River Oil Field
Unit's Location in Alaska

20' (6 meter) diameter 50' (15 meter) long Slug Catcher

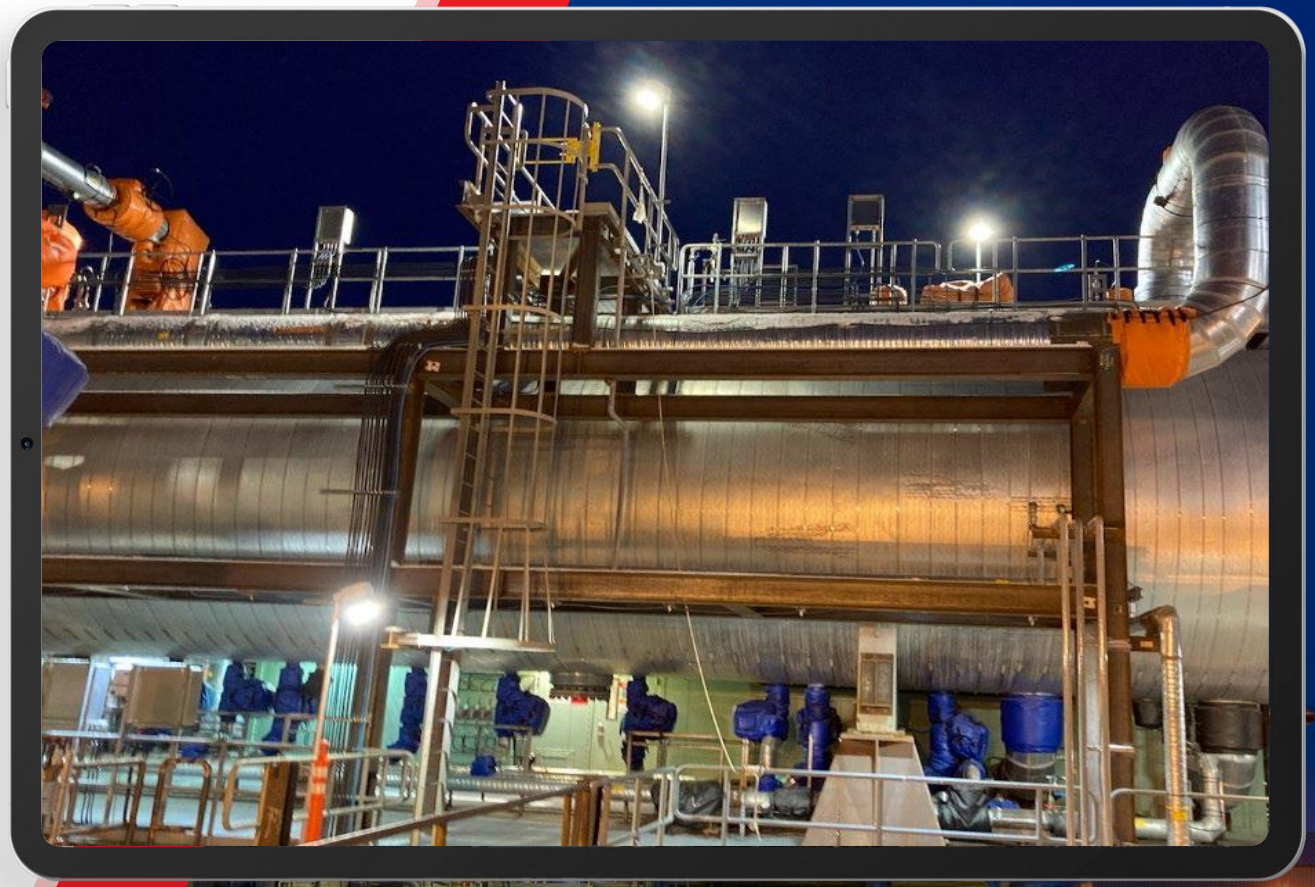
AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
SLUG CATCHER



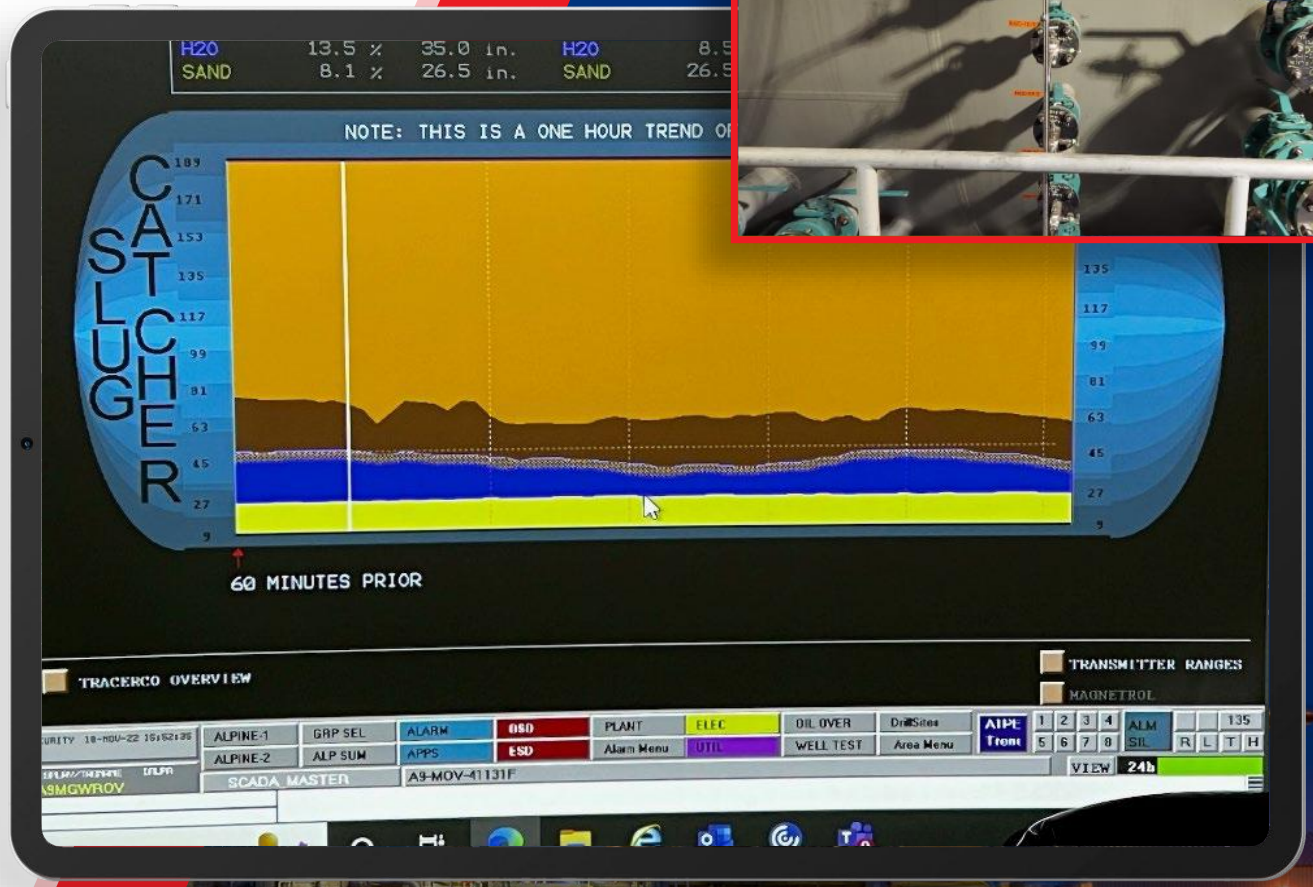
AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
SLUG CATCHER



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

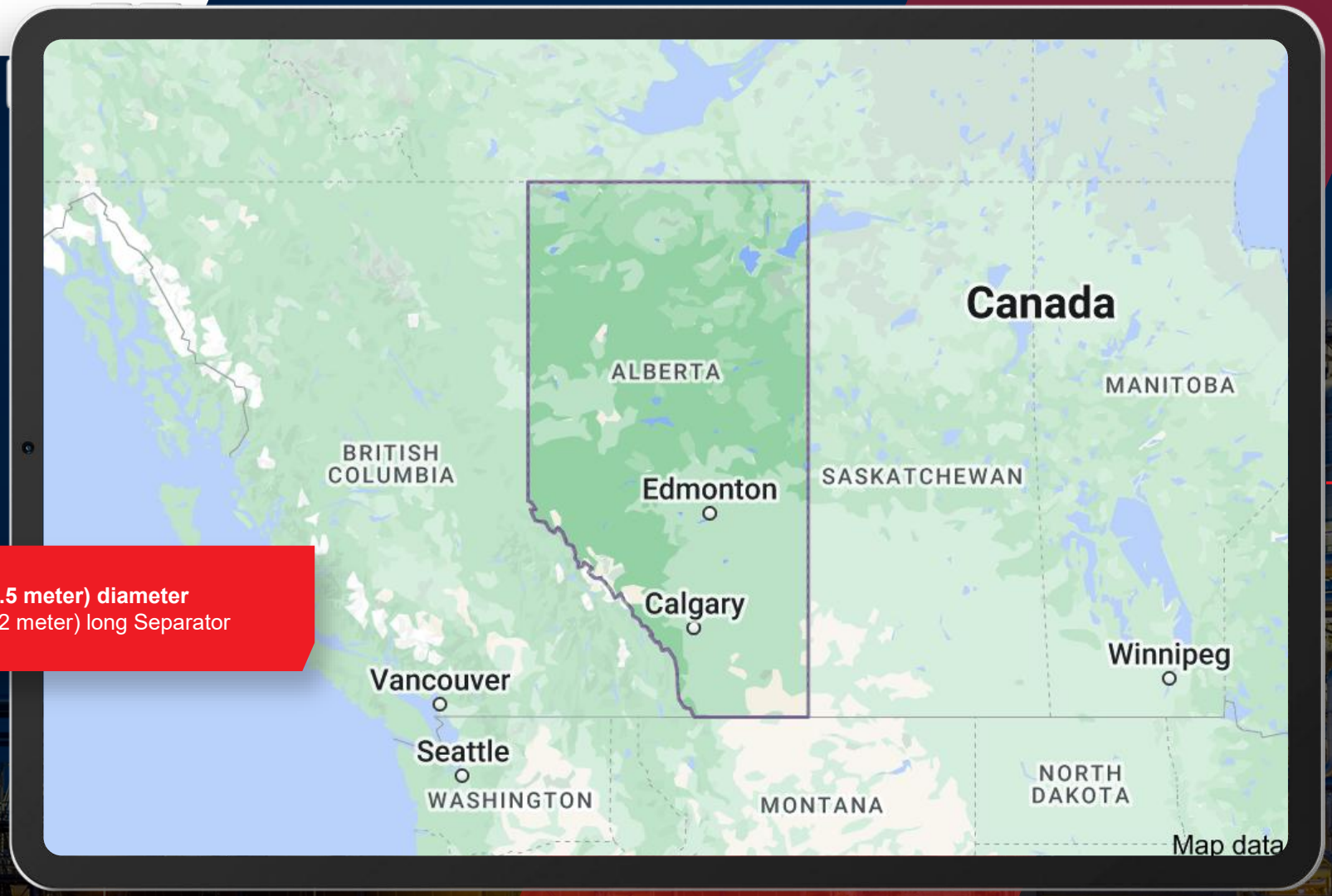
GENESIS
MULTIPHASE DETECTOR
SLUG CATCHER



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

Genesis
Tracerco

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

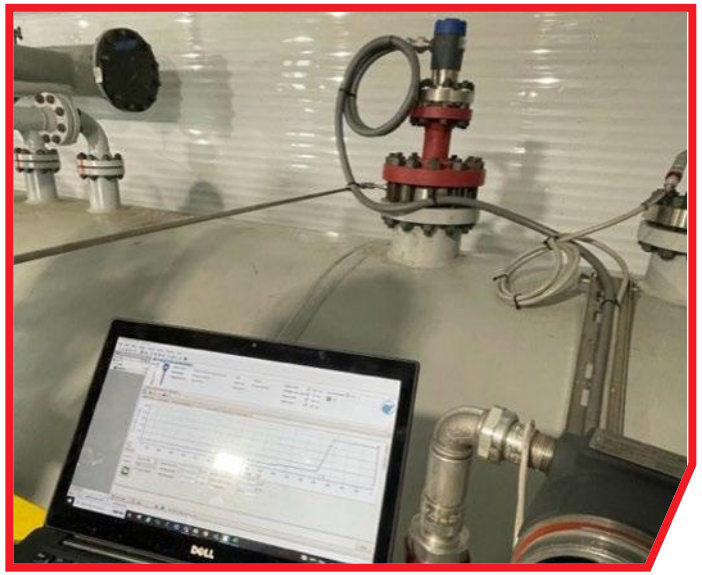


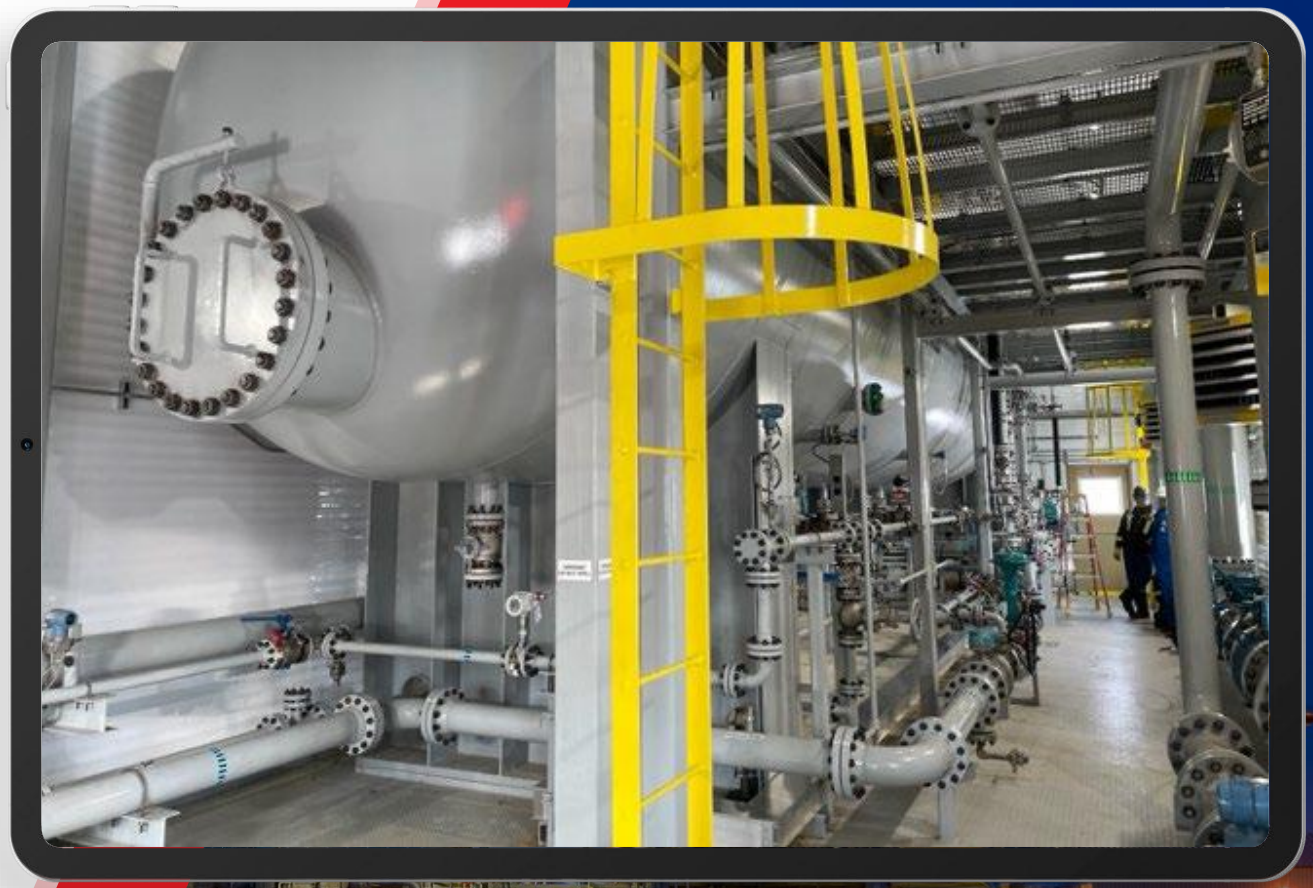
15’ (4.5 meter) diameter
40’ (12 meter) long Separator

Grand Prairie
Alberta, Canada

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
SEPARATOR





AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS

Kuparuk River Oil Field
Unit's Location in Alaska

12' diameter (3.5 meter) 40' (12 meter) long Separator

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

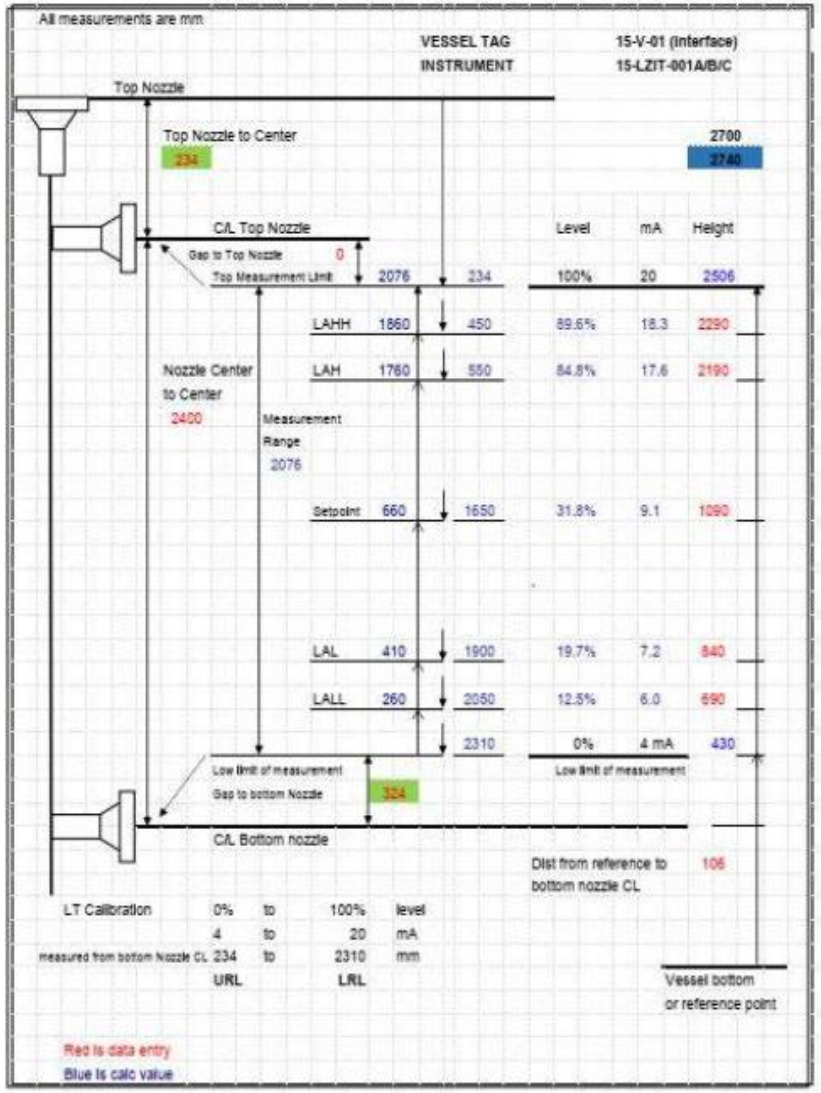
GENESIS
MULTIPHASE DETECTOR
SEPARATOR

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
FREEWATER KNOCK OUT

GENERAL	1	Tag No.	P&ID No.		15-LZIT-001A		KU-TWK-10-PR-PID-0300
	2	Service			FWKO / DEGASSER 15-V-01 CRUDE (INT) LEVEL		
	3	Line No.	Pipe Class		N/A		N/A
	4	Vessel/Tank No.	Vessel/Tank MOC		15-V-01		Carbon Steel with NACE
	5	Hazardous Area Classification			Zone 2 Gr IIA T3		
	6	Ambient Temperature (°C)	Min	Max	-10		50
PROCESS DATA	7	Upper Fluid	Lower Fluid		Crude oil		Produced water
	8	Dielec.Const.(Upper)	Dielec.Const.(Lower)		2-5		80
	9	Upper Fluid Density (Kg/m³)	Lower Fluid Density (Kg/m³)		875 - 954		1043.6
	10	Design Press. Min/Max (barg)	Design Temp. Min/Max (°C)		FV	12.6	-10 / 120
	11	Operating Pressure - Max/Nor/Min (barg)				4.5 - 7	
	12	Operating Temperature - Max/Nor/Min (°C)				20 - 60	
	13	Viscosity (cP)			0.4 - 20		
	14	BLANK			-		
	15	Type			Horizontal Mounted (FWKO / DEGASSER)		

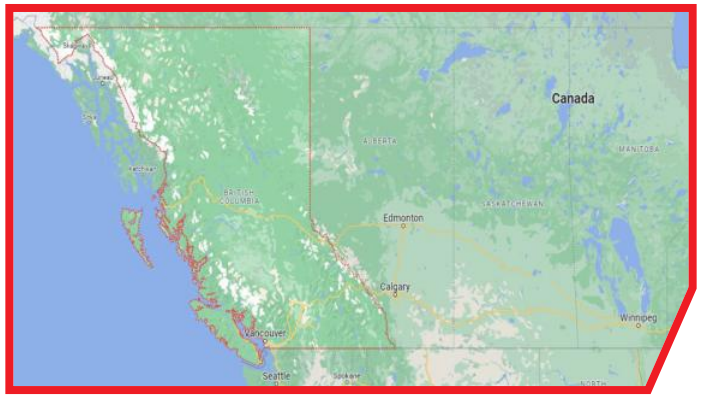
AMETEK®
LEVEL MEASUREMENT SOLUTIONS



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
DESALTER

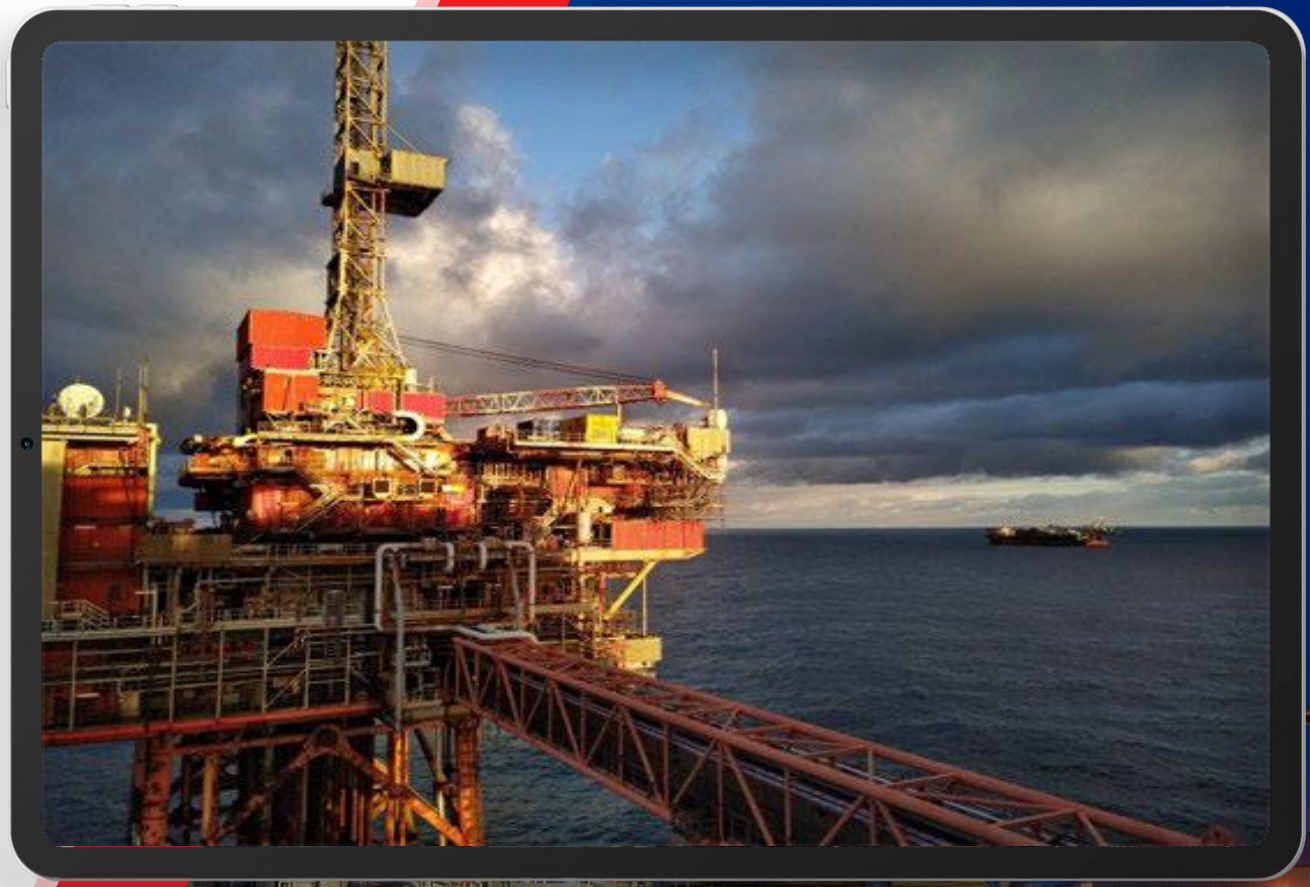
Prince George, British Columbia, Canada
8’ (2.5 meter) diameter 10’ (3 meter) long Desalter



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
North Sea – Offshore Platform

4.32 meter Pentarod – Direct Insertion
2.98 meter Pentarod – Side mounted chamber



AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR
Australia – Offshore Platform

4.74 meter Pentarod in Separator

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

GENESIS MULTIPHASE DETECTOR

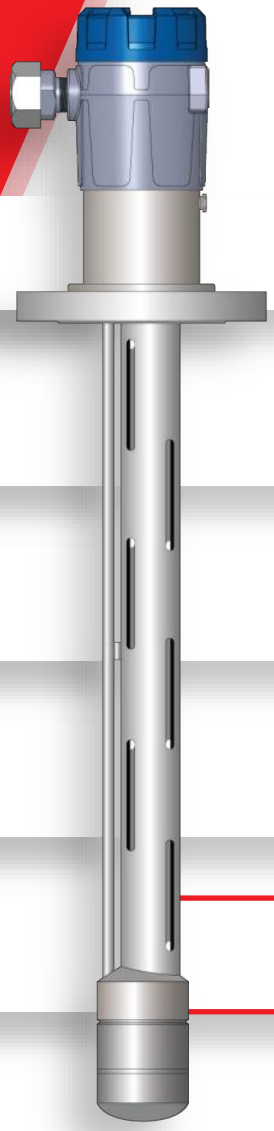
01 No calibration **necessary**

02 Easy to install with only **one top entry point required**

03 As small as **3” process connection**

04 Remote mount **to 100 feet**

05 Utilizes proven **TDR technology**



06 Profiler performance at an **economical price point**

07 Dynamic **emulsion detection**

08 Detection **of sand**

09 Four (4) 4-20mA outputs, one with **HART digital communication**

10 Several **patents received**

AMETEK® LEVEL MEASUREMENT SOLUTIONS

GENESIS
MULTIPHASE DETECTOR

01

System and Method
for Emulsion Measurement and Profiling

02

TDR Based Method
for Emulsion Detection and Profiling

03

TDR Instrument
with Bottom-Up Algorithm

04

“Pentarod”
Probe Design

AMETEK®
LEVEL MEASUREMENT SOLUTIONS

THANK YOU

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