

OVERCOMING CAPACITIVE EFFECTS ON INTERRUPTED SURVEYS WITH PCRX DECOUPLERS



AGENDA

- ✓ Capacitive effects on surveys
- ✓ Interrupted surveys
- ✓ AC mitigation and decouplers
- ✓ Traditional capacitance solutions
- ✓ The PCRX solution
- ✓ Example results
- ✓ How to know if you need a PCRX



DAIRYLAND

1983

Henry Tachick founded Dairyland, providing neutral isolators to address stray voltage concerns on dairy farms.



DAIRYLAND



1990 — ISP

Dairyland created the first solid-state device for high-power utility decoupling.



1994 — PCR

Dairyland introduced the first solid-state decoupling device for the corrosion industry.



DAIRYLAND

Today

Dairyland is the world's leading manufacturer of solid-state decouplers, with products installed in over 90 countries around the world.



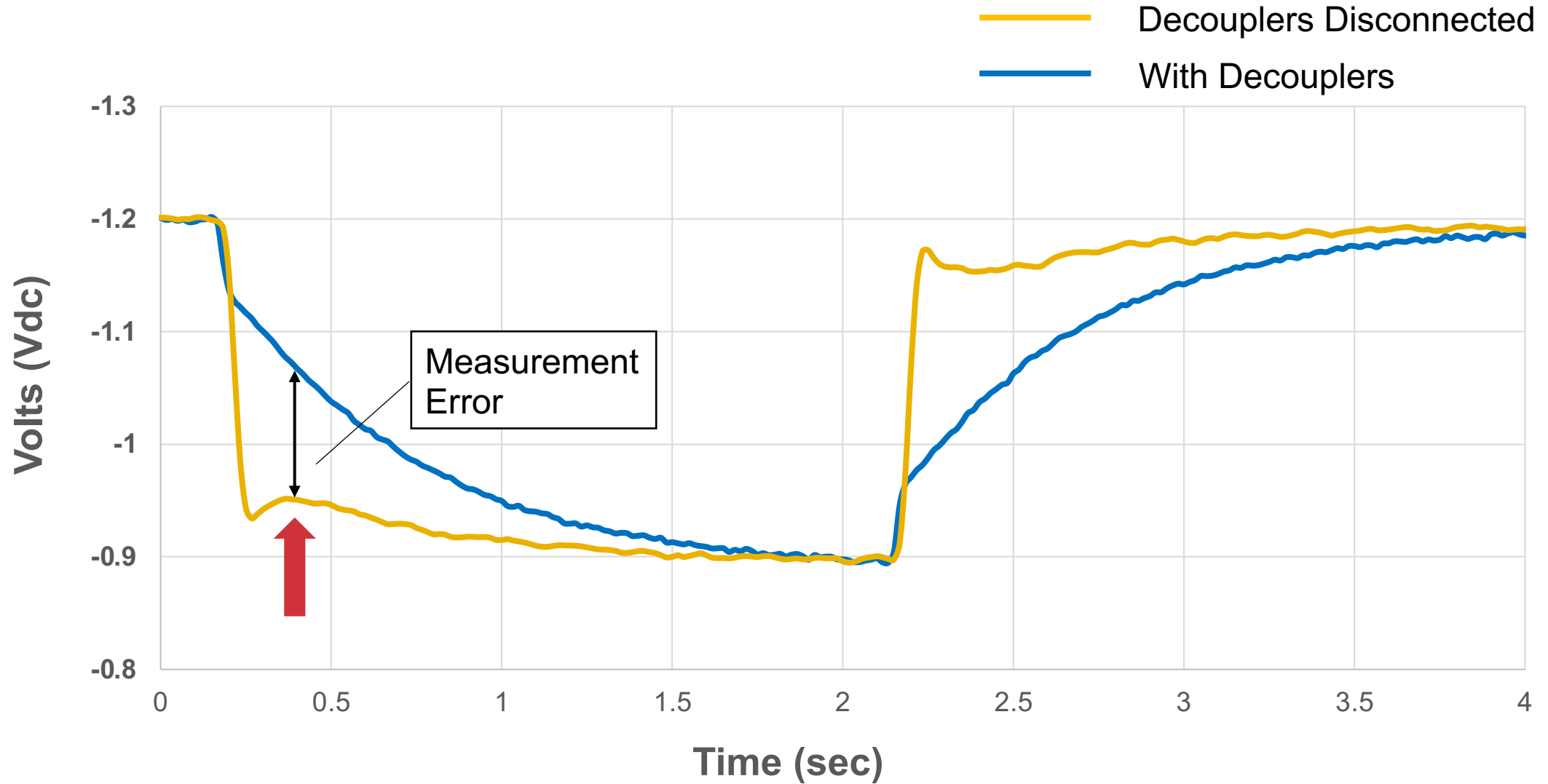
INTERRUPTED SURVEYS

Cathodic Protection

- Analyze per criteria
- Considers IR drop
- Reference half-cell



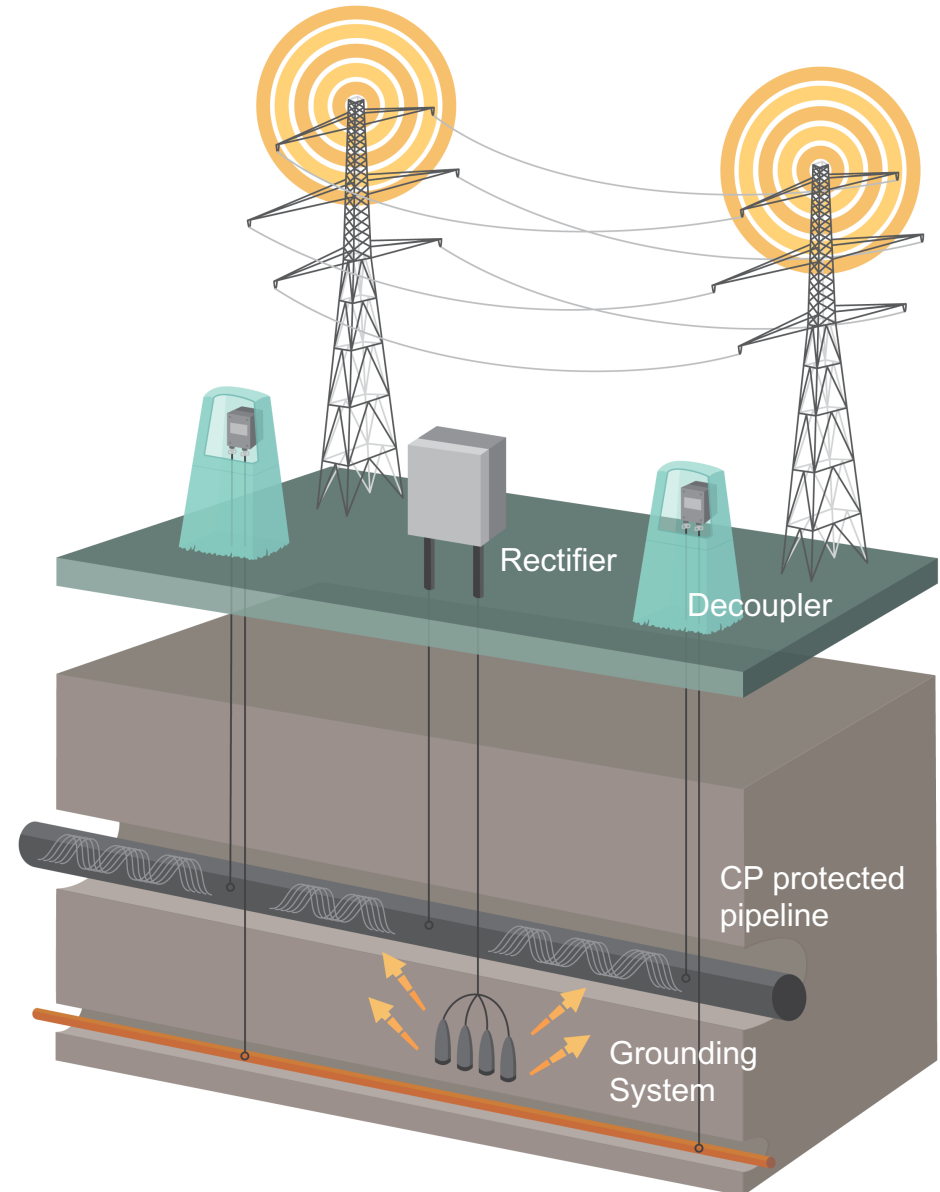
INTERRUPTED SURVEYS



AC MITIGATION

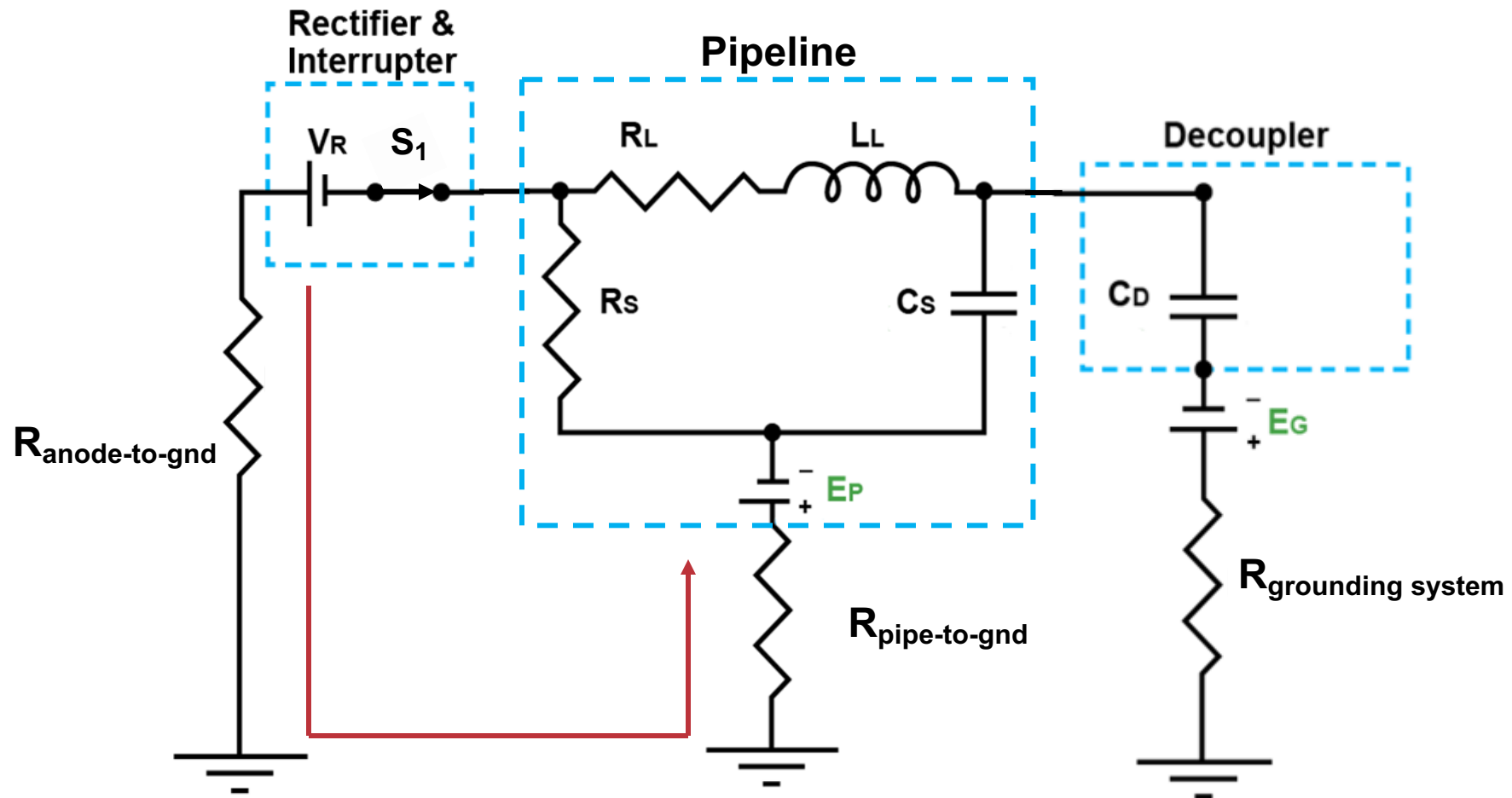
Decouplers

- CP isolation from ground
- AC continuity and grounding
- Capacitance introduced



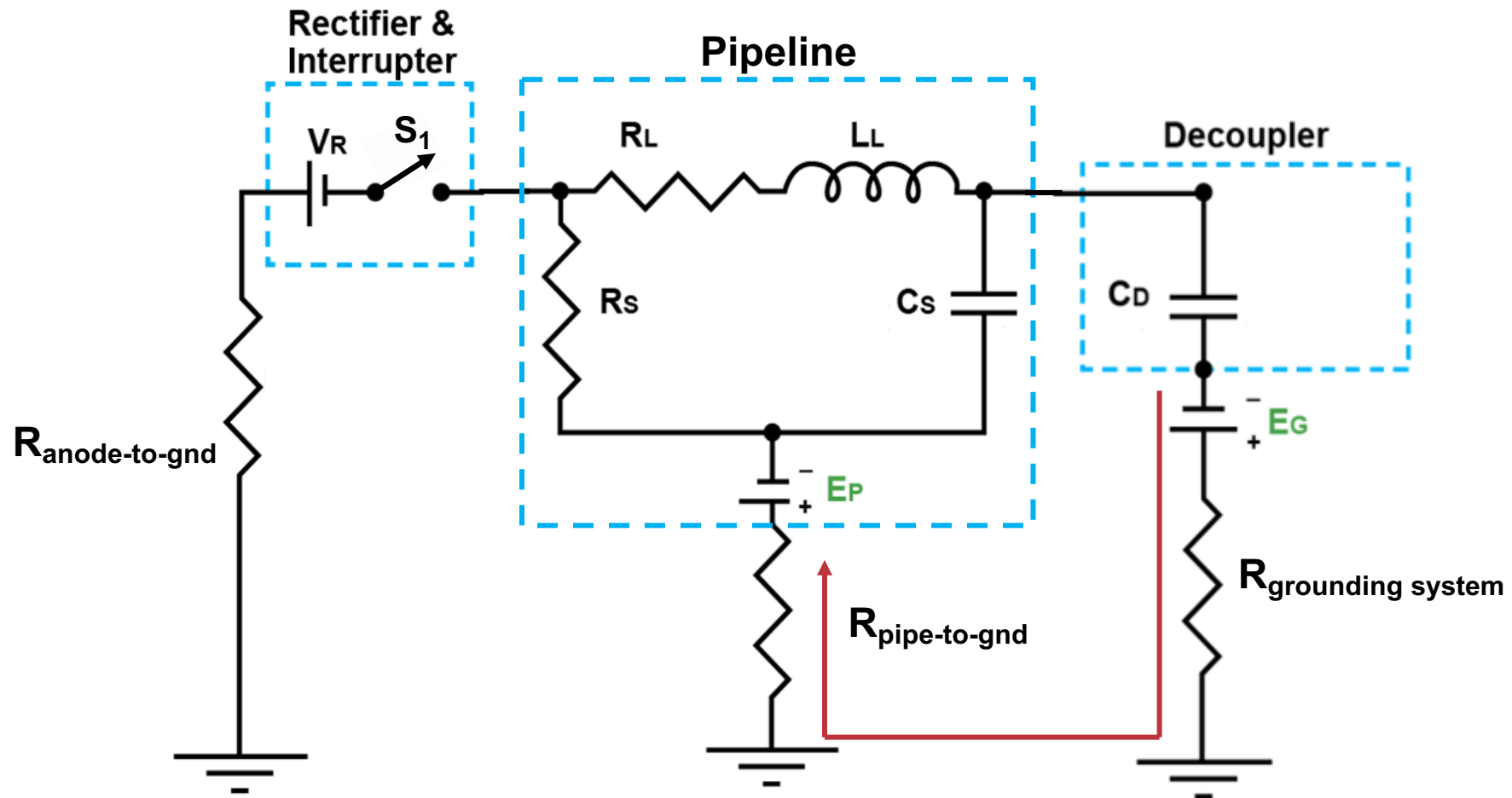
WHY DOES THIS OCCUR?

“ON” Cycle



WHY DOES THIS OCCUR?

“OFF” Cycle



WHERE DOES THIS OCCUR?

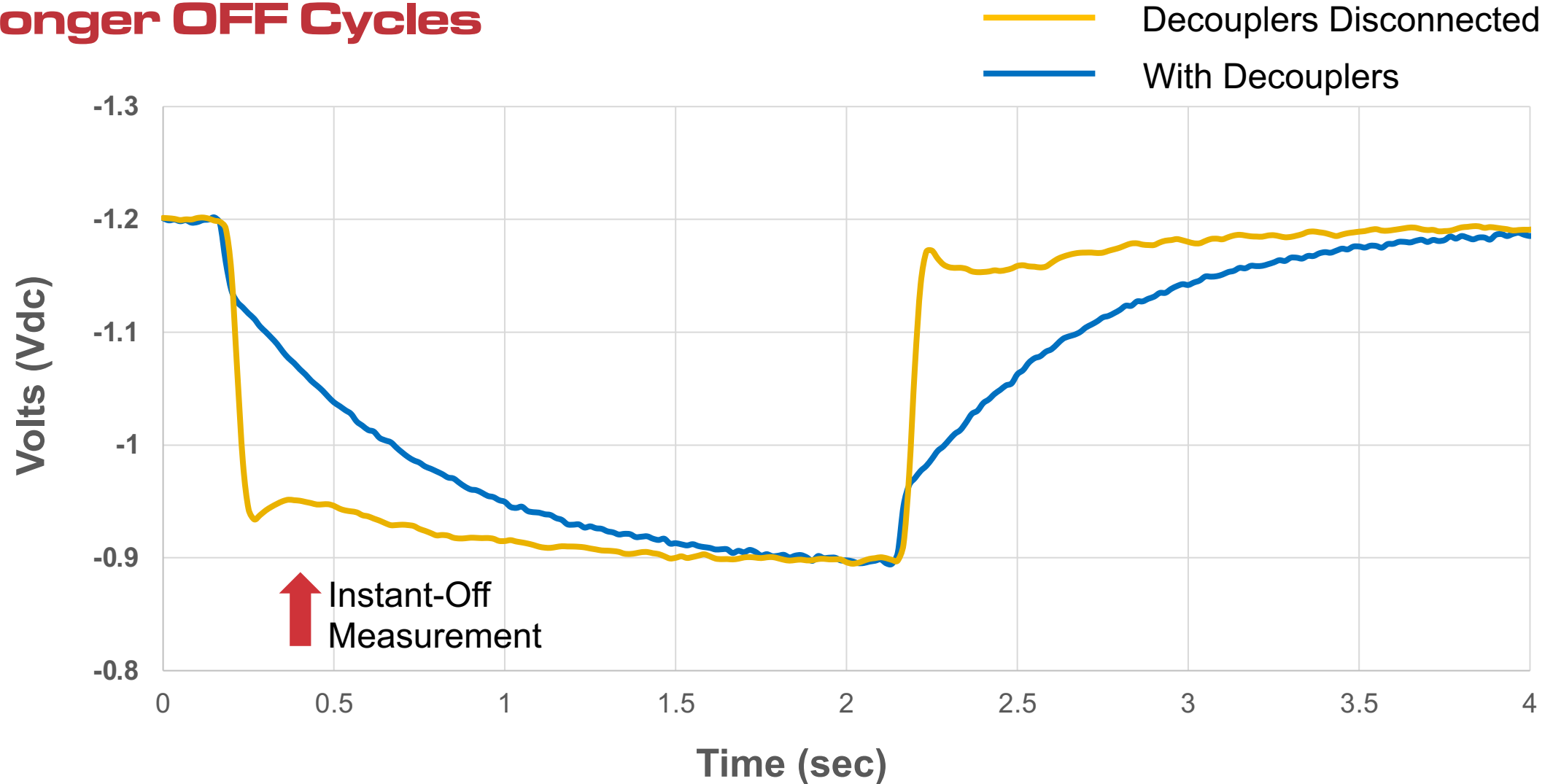
Commonly observed with:

- High resistivity soils
- High resistance coatings
- Short, small diameter pipe – i.e., less surface area
- Many decouplers on the same circuit



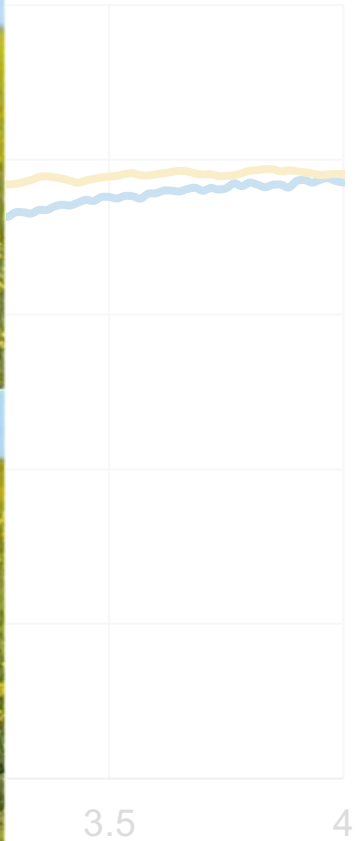
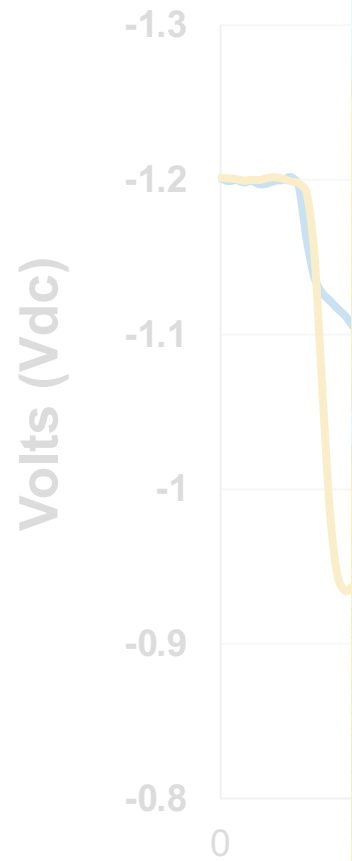
TRADITIONAL SOLUTIONS

Longer OFF Cycles



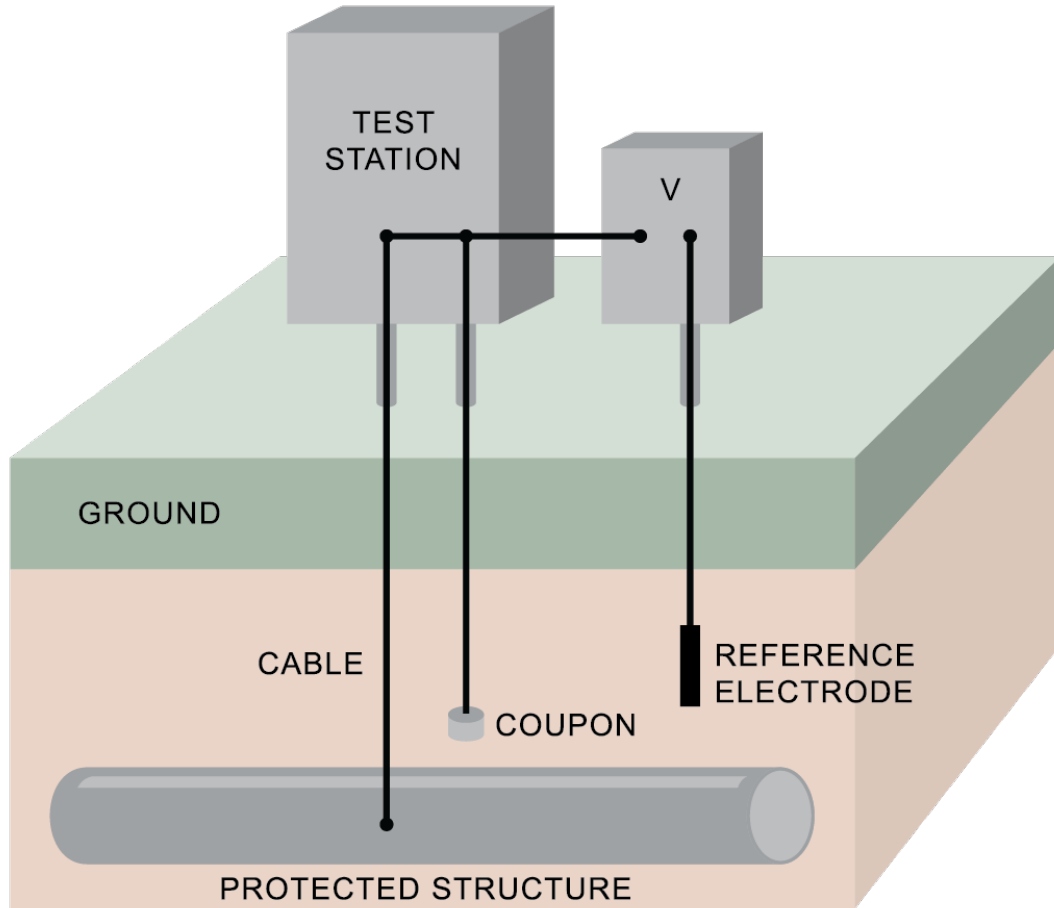
TRADITIONAL SOLUTIONS

Longer OFF



TRADITIONAL SOLUTIONS

IR-Free Coupons



TRADITIONAL SOLUTIONS

IR-Free Coupons

Coupons typically not spaced for CIPS



TRADITIONAL SOLUTIONS

Disconnect Decouplers

- Disconnect conductors
- Isolation switches
 - Switches must be rated for AC fault and continuous current



TRADITIONAL SOLUTIONS

Disconnect Decouplers

- Disconnect conductors
- Isolation switches
 - Switches must be rated for AC fault and continuous

No AC mitigation while disconnected
Survey takes longer = increased cost



TRADITIONAL SOLUTIONS

Potential Solution	Challenge
Geosynchronous interrupters at each decoupler	Added cost and time No AC mitigation during OFF cycle
Remotely controlled switches at each decoupler	No AC mitigation while disconnected



A NEW SOLUTION

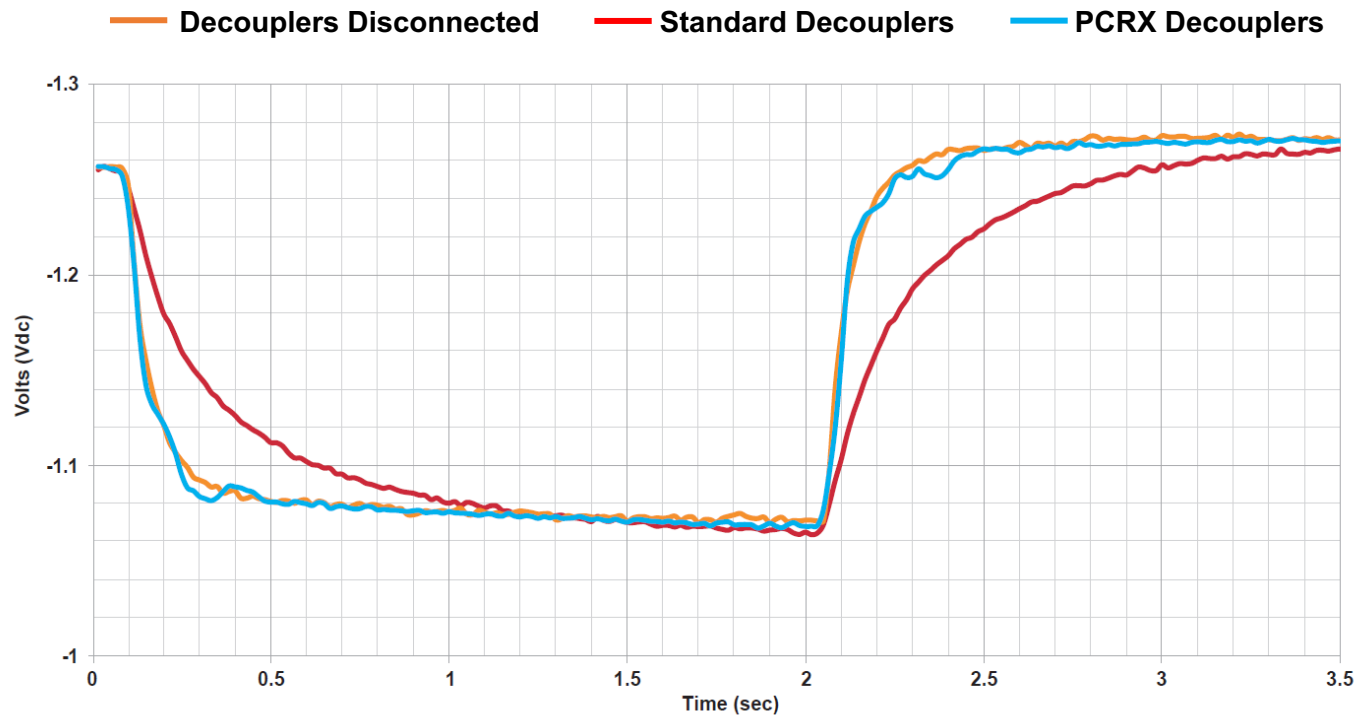
PCR^X

Dairyland's most innovative decoupler

- Proprietary control circuitry actively compensates for capacitive response
- No need to disconnect during survey
- Continuous protection for personnel and pipeline
- Ensures accurate and timely off-readings
- All while performing:
 - DC isolation
 - AC mitigation
 - Safety grounding

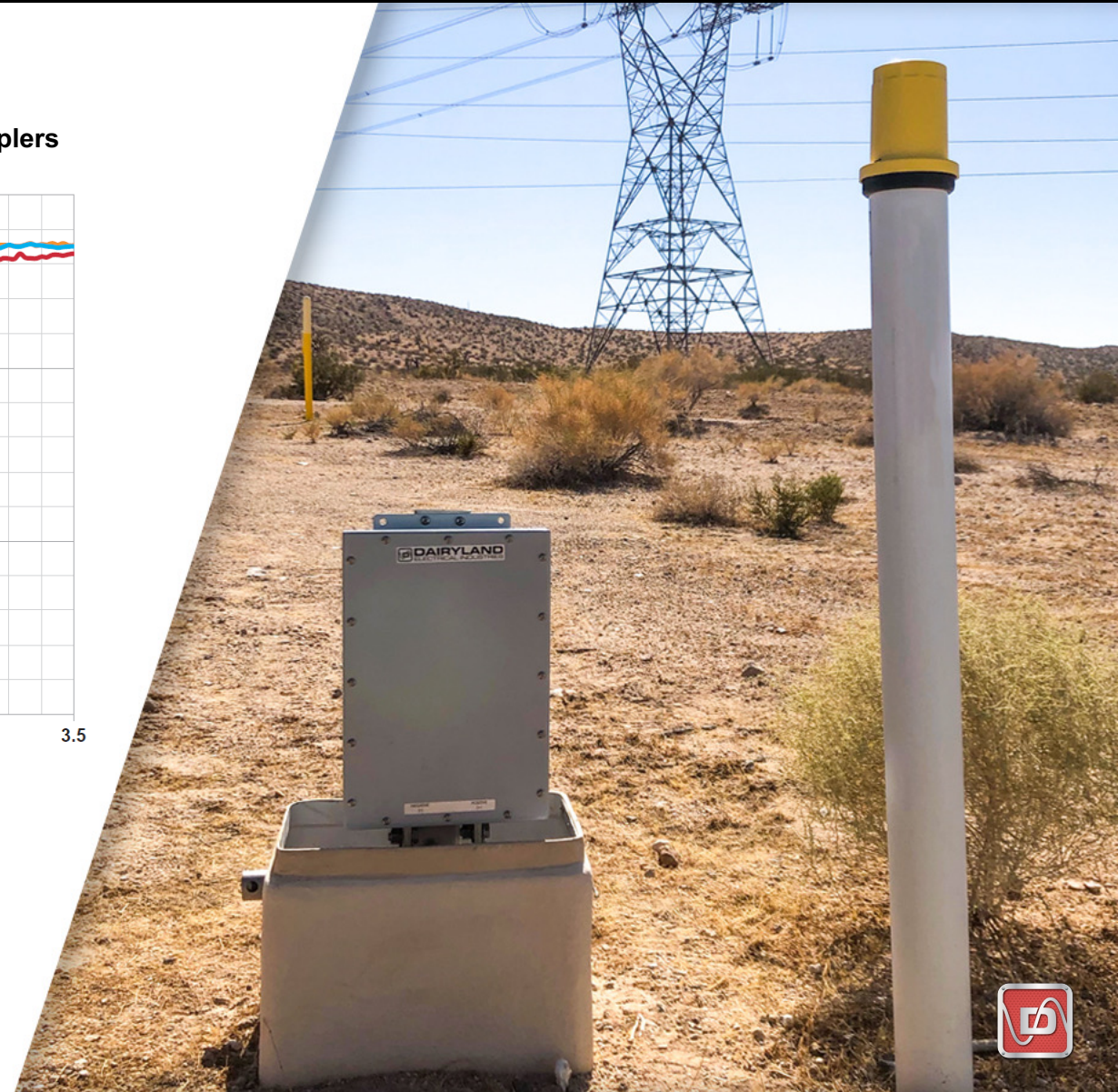


EXAMPLES

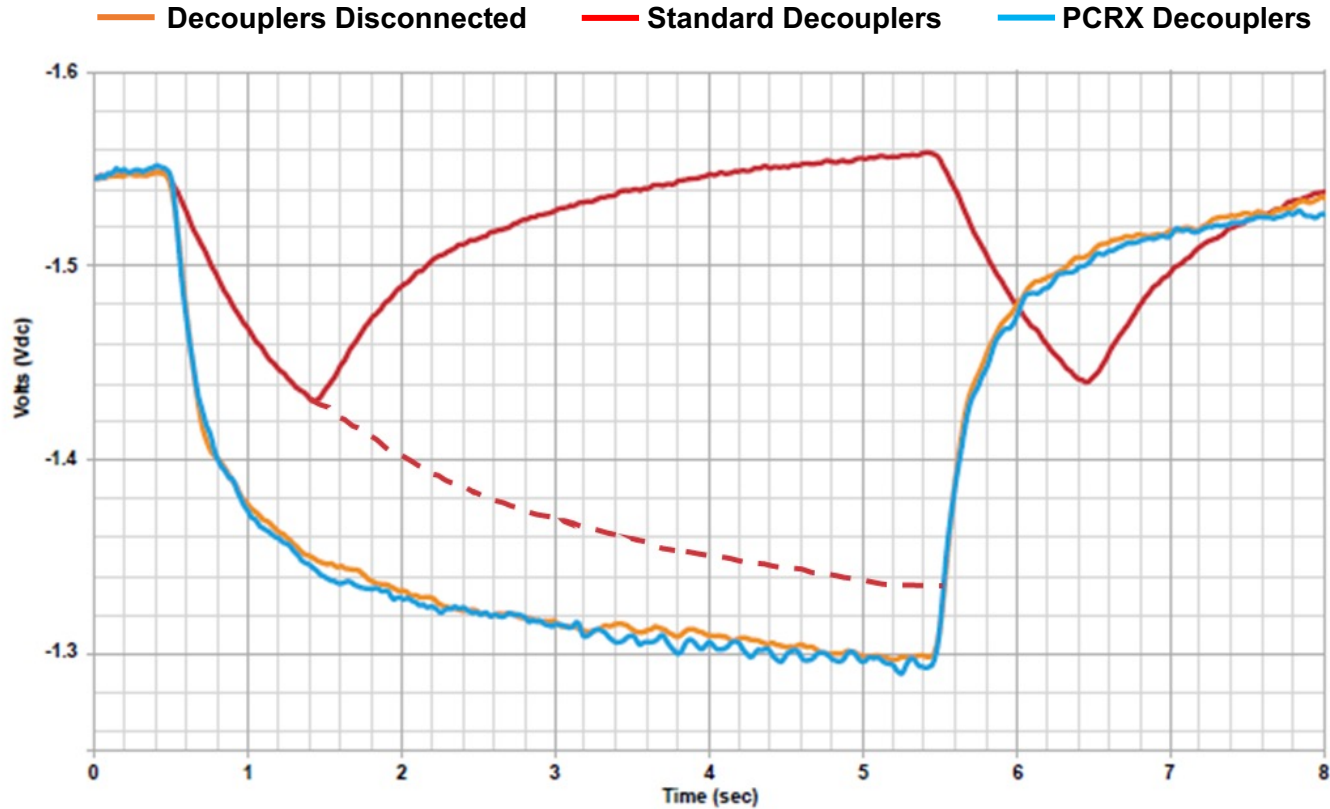


Installation location: Western US
Isolated 24" diameter pipeline
Pipeline coating: FBE

Length of pipeline segment: 3.2 miles
Soil conditions: Sandy/Dry
No. of decouplers: 8



EXAMPLES



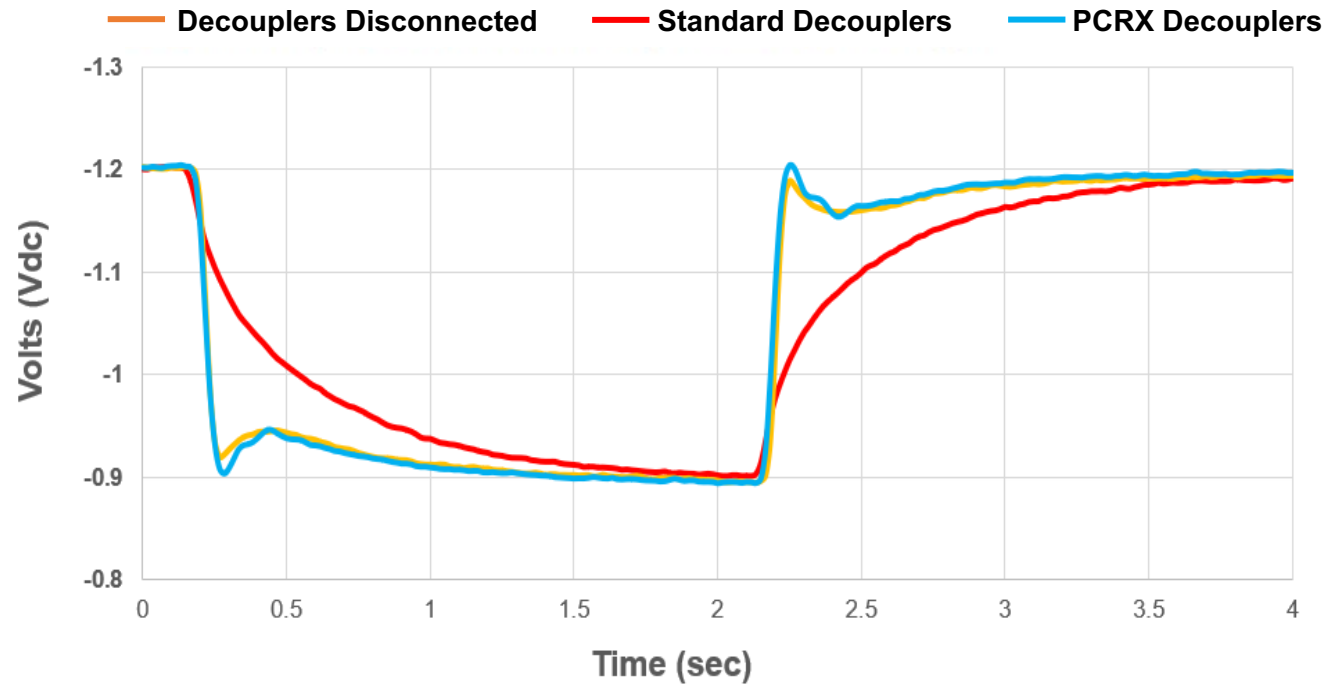
Installation location: Midwestern US
Pipeline Diameter: 6 in and 8 in
Pipeline coating: FBE

Non-isolated lateral segment

Length of pipeline segment: 2 miles
Soil conditions: Moist farm topsoil
No. of decouplers: 8



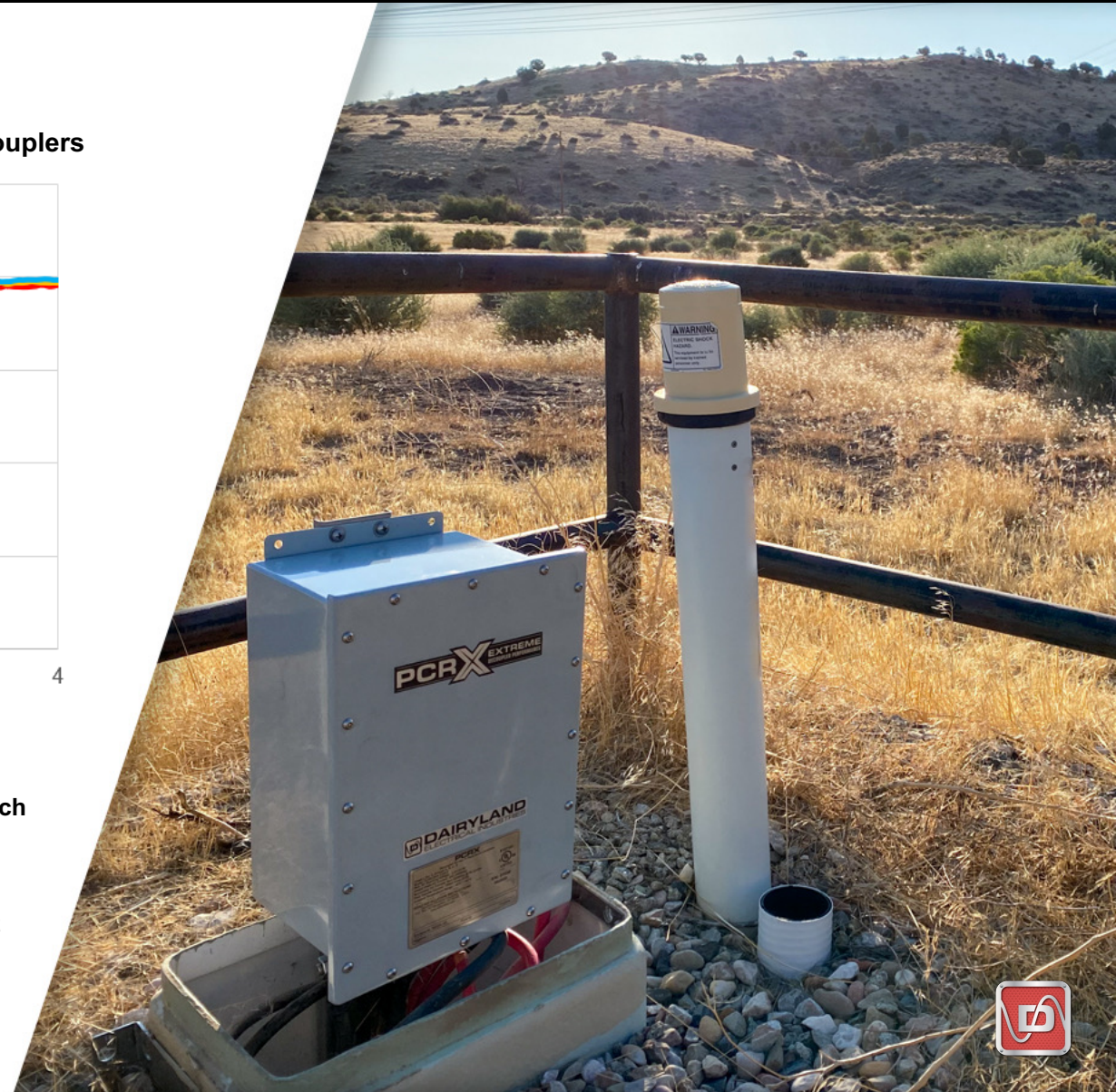
EXAMPLES



Installation location: Western US
Pipe Diameter: 36"
Pipeline coating: FBE

Length of pipeline segments: 11 miles each
Soil conditions: Sandy/Dry
No. of decouplers: 11 and 14

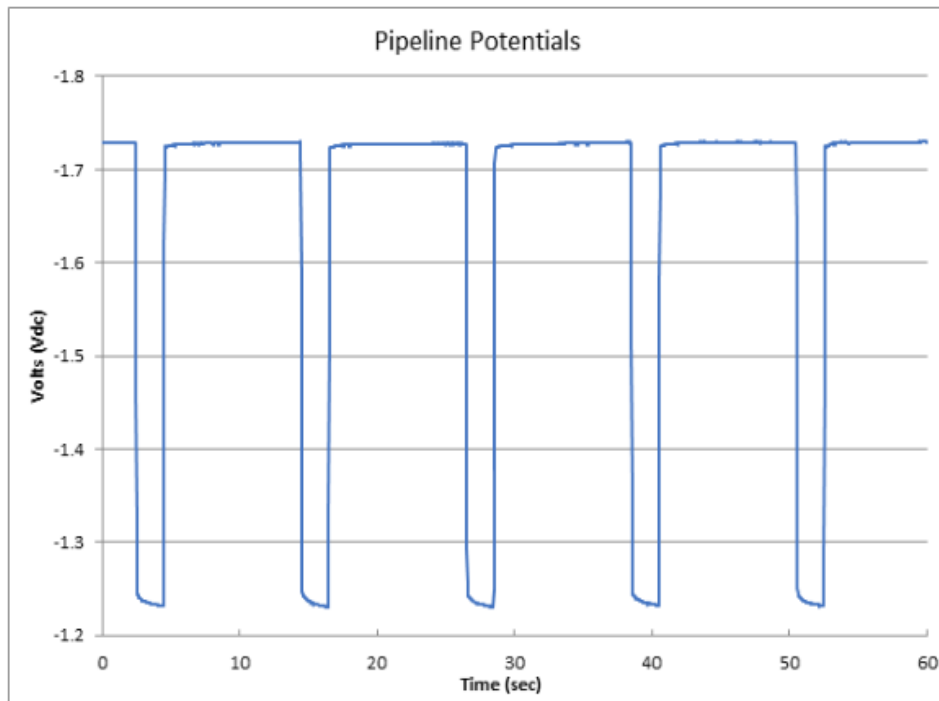
5 standard decouplers remain connected 4 miles from one end of this pipeline segment



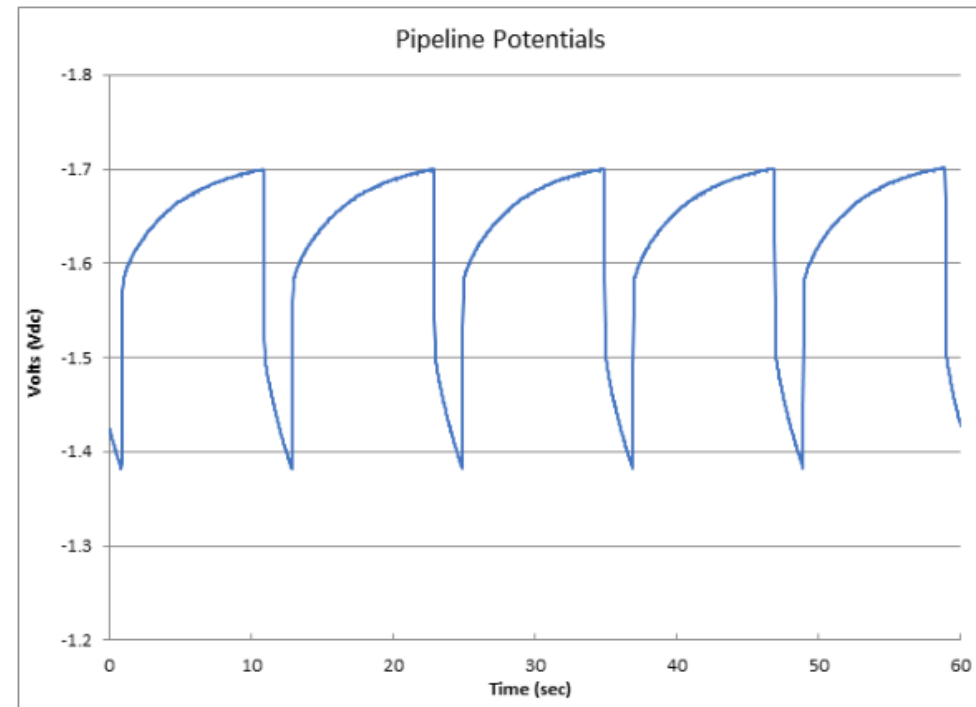
HOW DO I KNOW IF I NEED A PCRX?

Installations with existing conventional decouplers

Typical Acceptable Response



Typical Unacceptable Response



HOW DO I KNOW IF I NEED A PCRX?

New Installations

LESS CAPACITIVE EFFECTS

- Poor coating (low resistance)
- Larger diameter pipeline
- Moist soil conditions regularly
- Few decouplers



MORE CAPACITIVE EFFECTS

- Good coating (high resistance)
- Smaller diameter pipeline
- Dry soil conditions regularly
- Many decouplers



HOW DO I KNOW IF I NEED A PCRX?

New Installations

- If uncertain, consider testing the new pipeline for the capacitive effect
 - The Dairyland CAD-270 test device replicates the instant-off response of a PCR/SSD
 - A low-cost option
 - For temporary evaluation only – not for permanent installation



CAD-270



CAPACITANCE - TESTING

Summary:

- Identify sources of capacitance
- Analyze waveforms
 - With NO decouplers
 - With Decouplers OR CAD-270
- Determine best solution for accurate readings
 - Standard Decouplers (if no capacitance effect)
 - Delayed OFF Reading
 - Isolate Standard Decouplers
 - New Generation Decouplers (PCRX)



CAD-270



PCRX APPLICATION CONSIDERATIONS

PCRX impedance varies with AC current

AC CURRENT THROUGH PCRX (A-AC _{RMS})	PCRX MAXIMUM AC IMPEDANCE (OHMS)
<0.6	5.000
0.7	0.800
1.0	0.437
2.0	0.127
5.0	0.059
15.0	0.034
25.0	0.029
35.0	0.028
45.0	0.027



PCR X APPLICATION CONSIDERATIONS

PCR X Impedance Varies with AC Current

- Similar benefits at all current levels, i.e.,
 - More accurate instant-off measurements
 - CP isolation
 - Safety grounding
 - Over-voltage protection
- But the effects of higher impedance should be considered:
 - AC Voltage Drop: Impacts blocking threshold selection and the maximum DC operating voltage
 - AC Current Density: Though AC voltage across the PCR X terminals will not exceed 2VACrms, AC current density measured on the pipeline may increase.
 - Transition from high to low impedance modes can take up to 15 seconds. CP potentials may be affected.

Benefits

- Faster & lower-cost surveys
- More accurate measurements
- Increased safety



CONTACT DAIRYLAND TO DISCUSS APPLICATIONS

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DAIRYLAND
ELECTRICAL INDUSTRIES

ALWAYS RUGGED. ALWAYS RELIABLE.