

Mears Group, Inc.



Close Interval Surveys By Jim Walton

INTEGRITY SOLUTIONS
PREVENTION ▲ INSPECTION ▲ REMEDIATION



A QUANTA SERVICES COMPANY

A good coating applied to the pipeline is the primary defense against external corrosion of the metal structure. Additional protection against corrosion is accomplished with cathodic protection or CP.

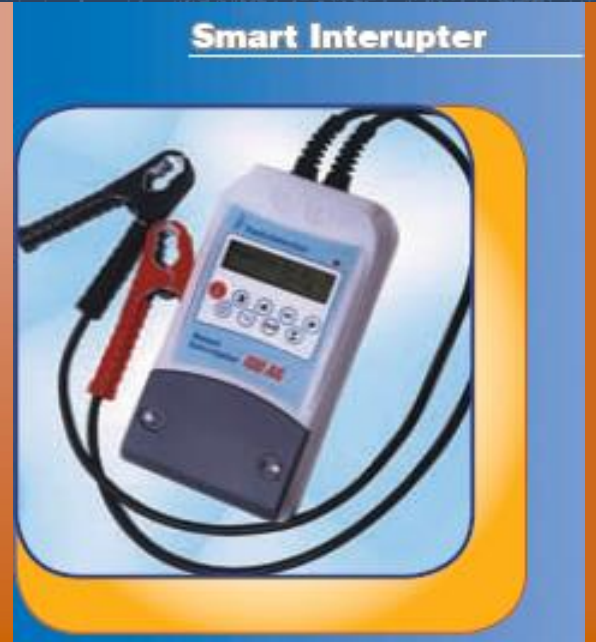
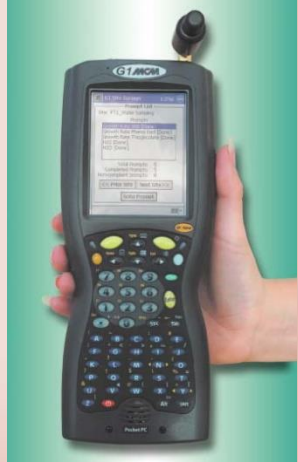
There are two types of CP systems designed to protect steel structures surrounded by conductive electrolyte, such as soil and water:

- Galvanic
- Impressed Current

Principals of CIS

- A DC structure-to-electrolyte potential is collected during both the CP “on” state and the CP instant “off” state
- Spacing is determined by depth of pipeline and 3 – 5 – 10 foot spacing is common
- All influencing current must be interrupted
- All interrupters must be synchronized
- Sufficient ground contact must be achieved

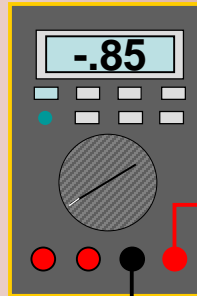
CIS tools



What can CIS data tell us?

- It is a macro tool that gives us a relative state of the cathodic protection on the pipeline and can find:
 - Areas of adequate and inadequate protection
 - Large coating defects
 - Possible interference areas
 - Shorted casings

Example voltage reading
note polarity sign



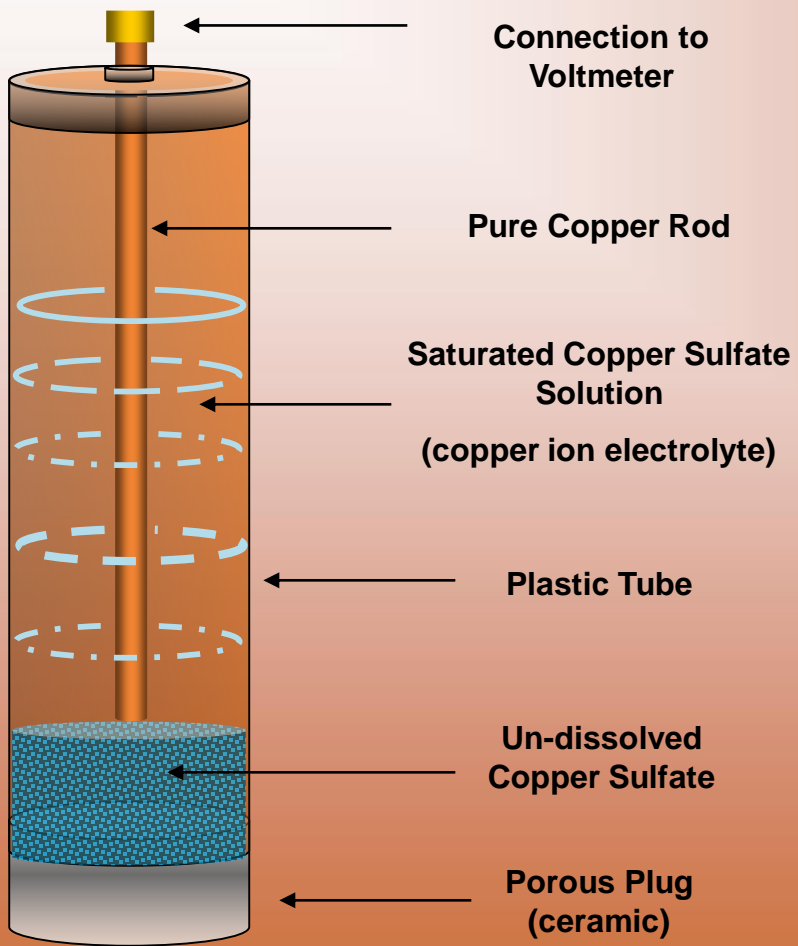
Connect voltmeter (positive)
lead to Steel Structure



Connect common
(negative) lead to
Copper/Copper
Sulfate Electrode

High Resistance Voltmeter and Cu/SO₄ Reference Electrode

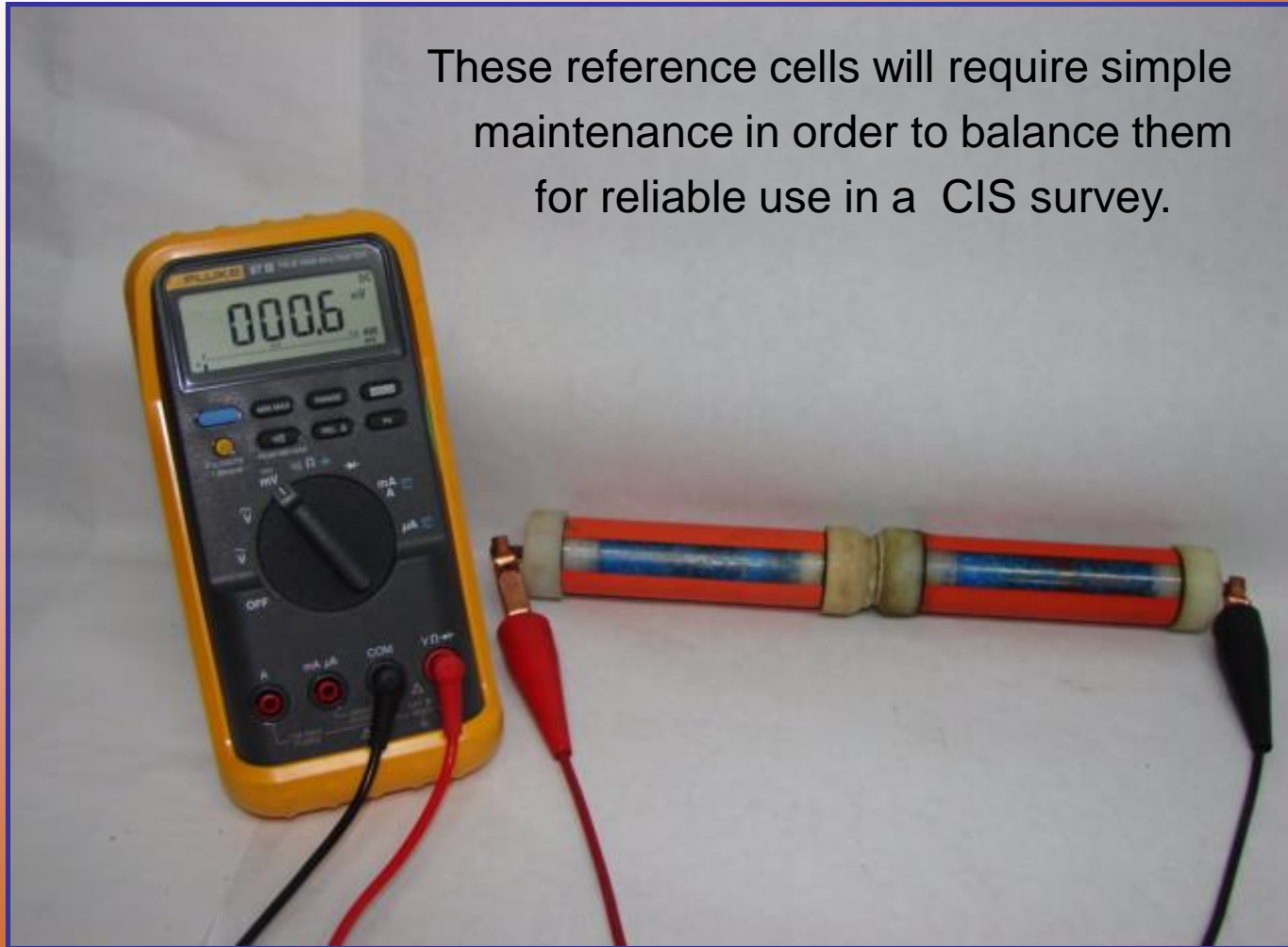
Steel pipe

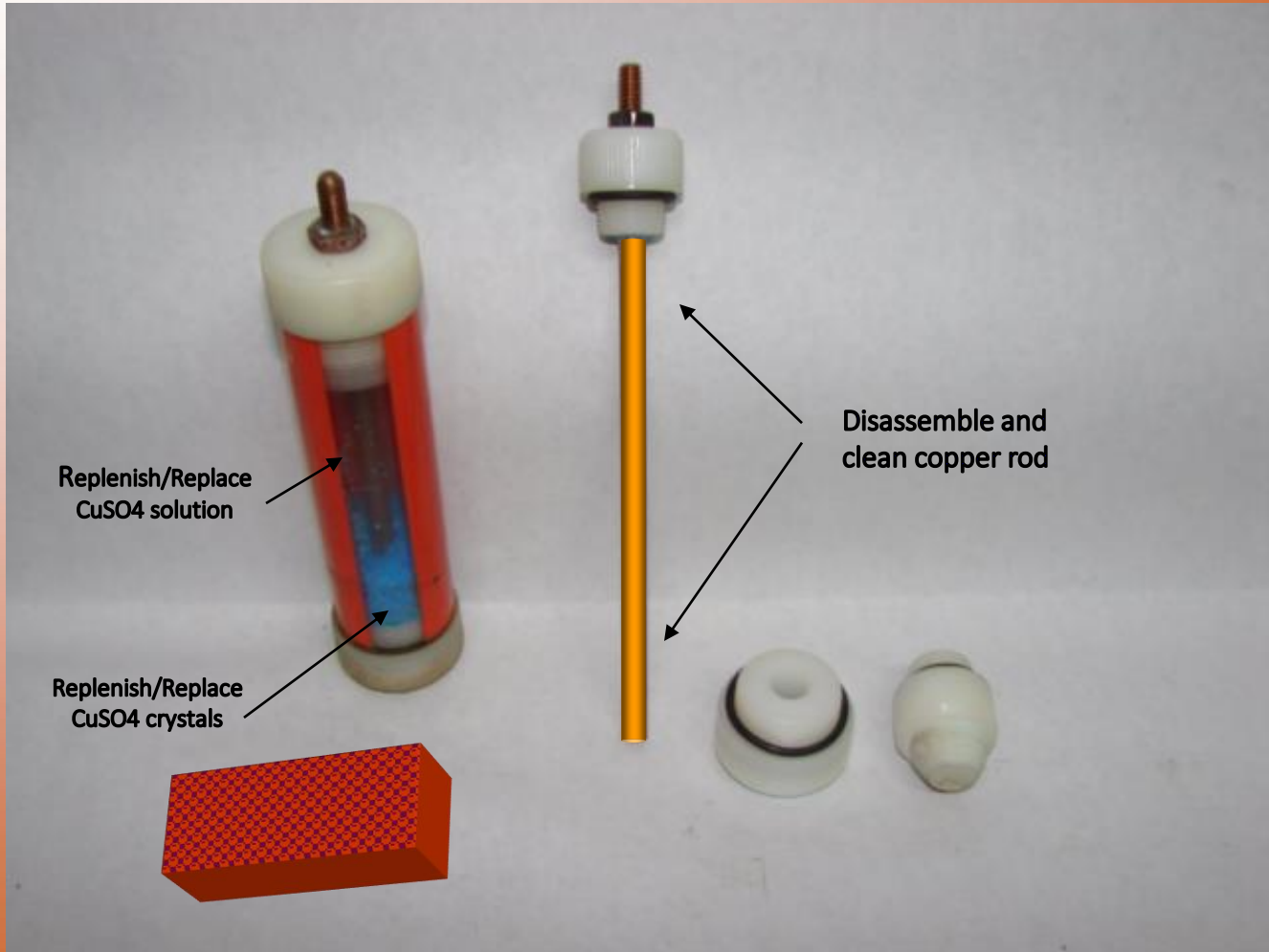


**Standard Reference Half Cell
(Cu-CuSO₄ Electrode)**



These reference cells will require simple maintenance in order to balance them for reliable use in a CIS survey.



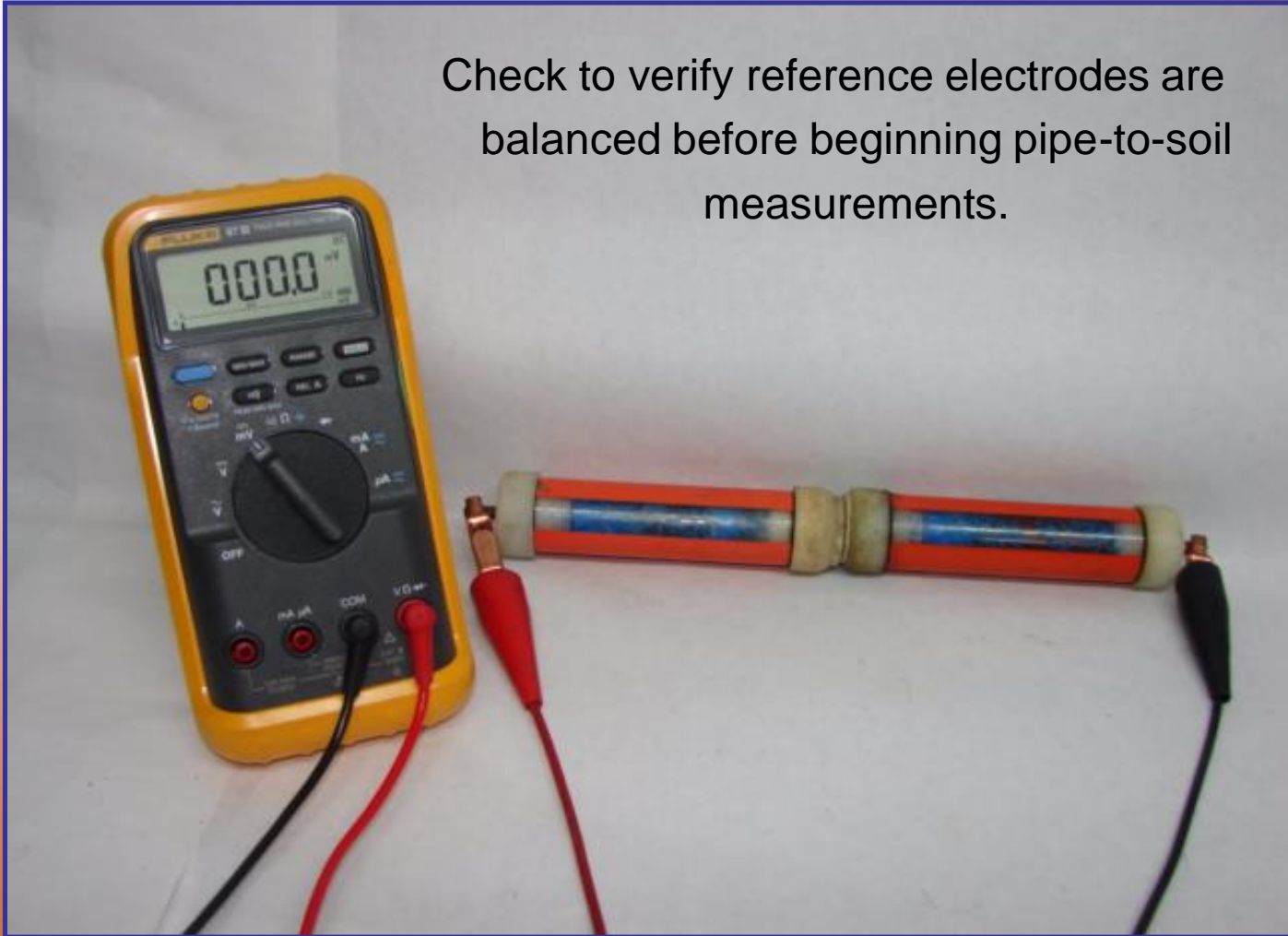


Replenish/Replace
CuSO₄ solution

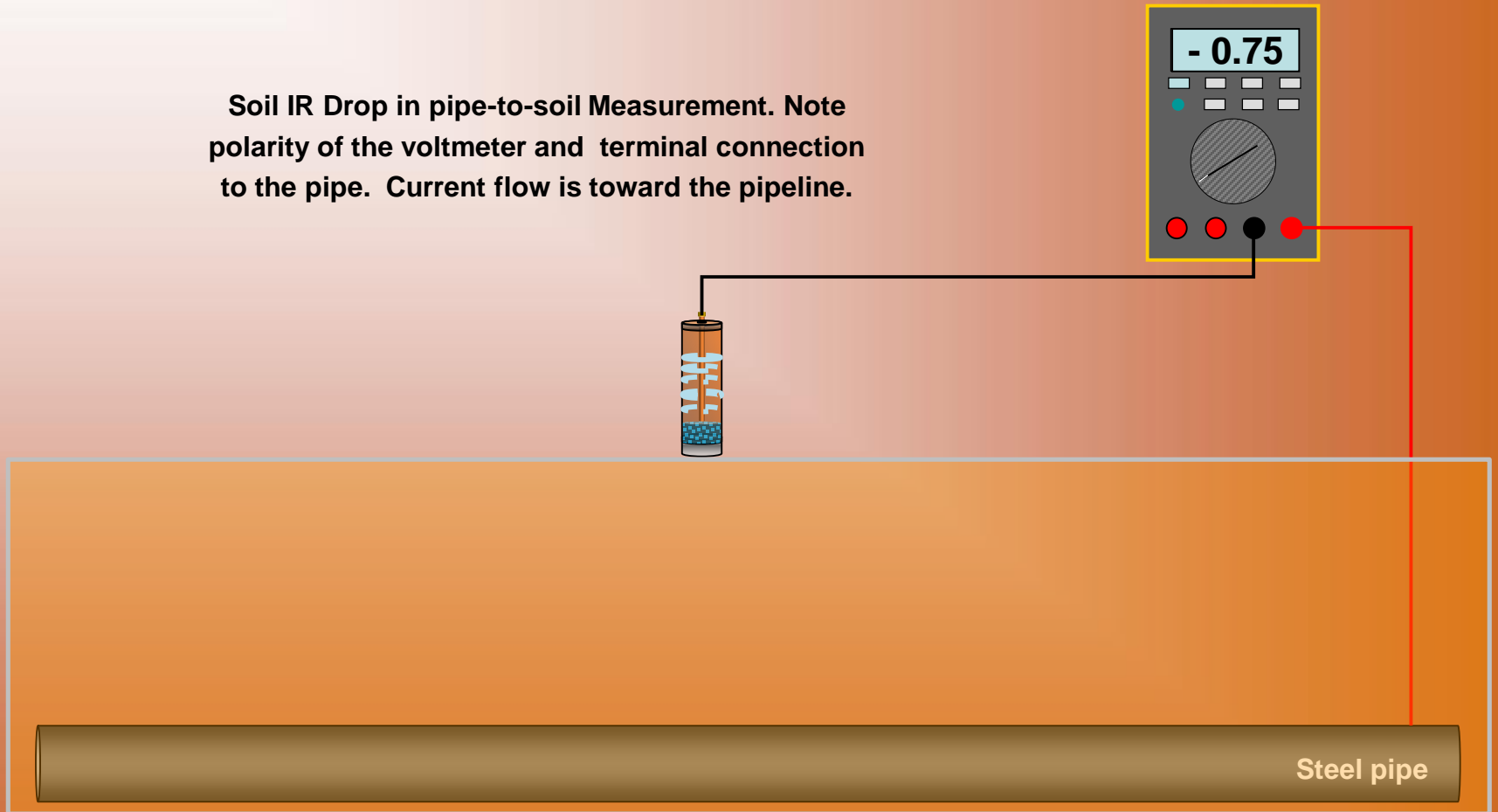
Replenish/Replace
CuSO₄ crystals

Disassemble and
clean copper rod

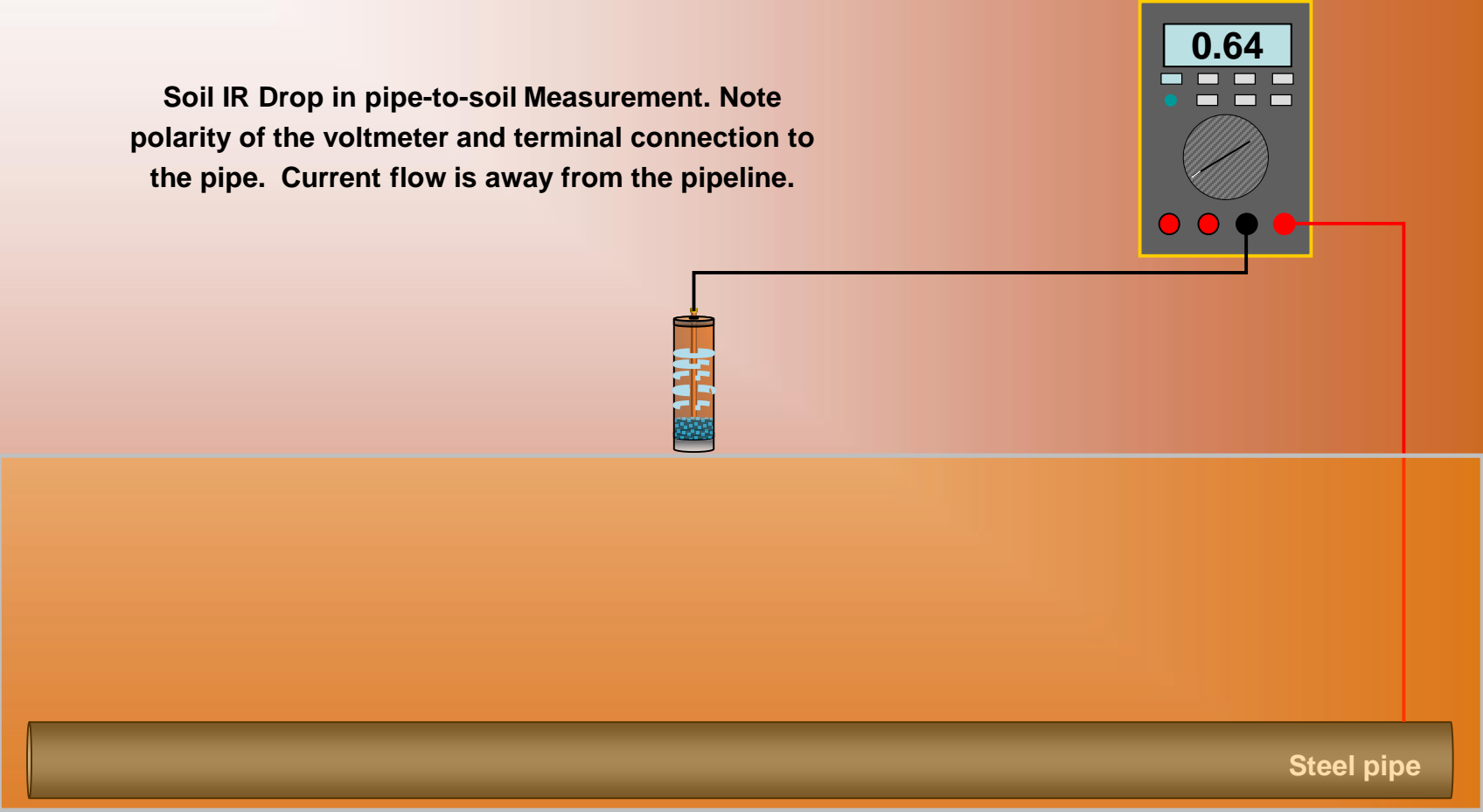
Check to verify reference electrodes are balanced before beginning pipe-to-soil measurements.



Soil IR Drop in pipe-to-soil Measurement. Note polarity of the voltmeter and terminal connection to the pipe. Current flow is toward the pipeline.

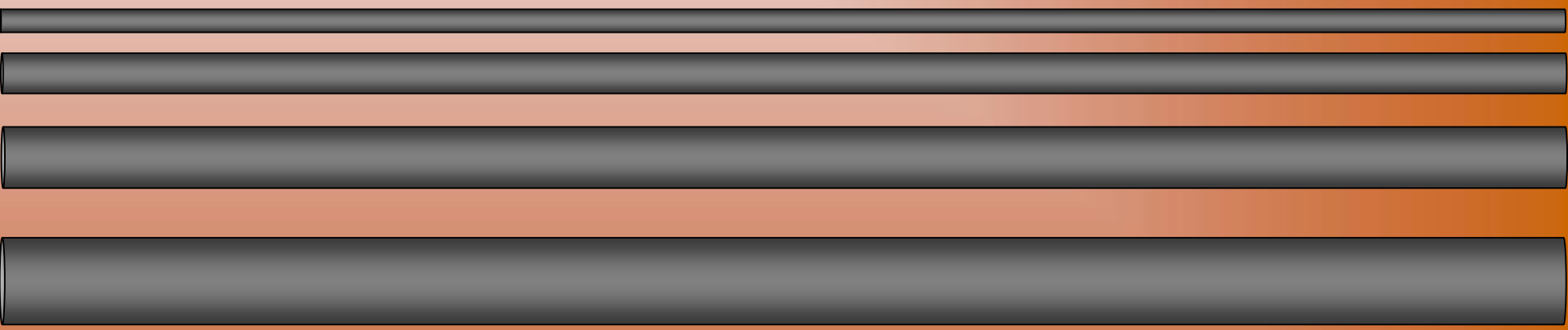
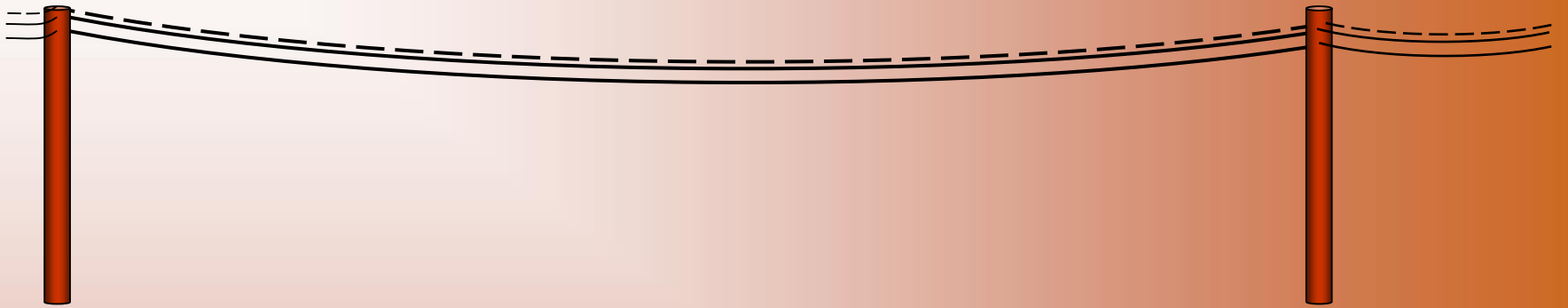


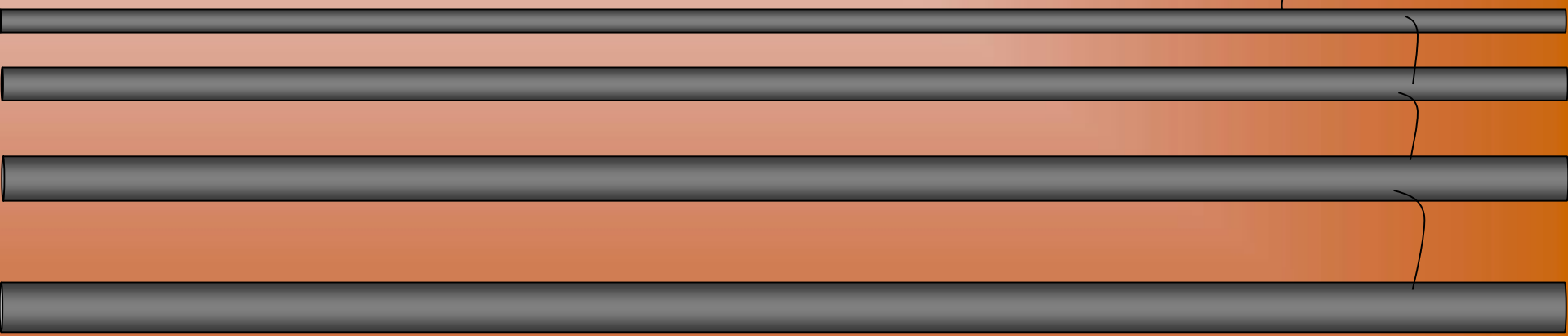
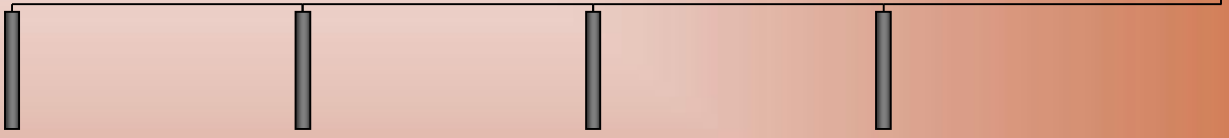
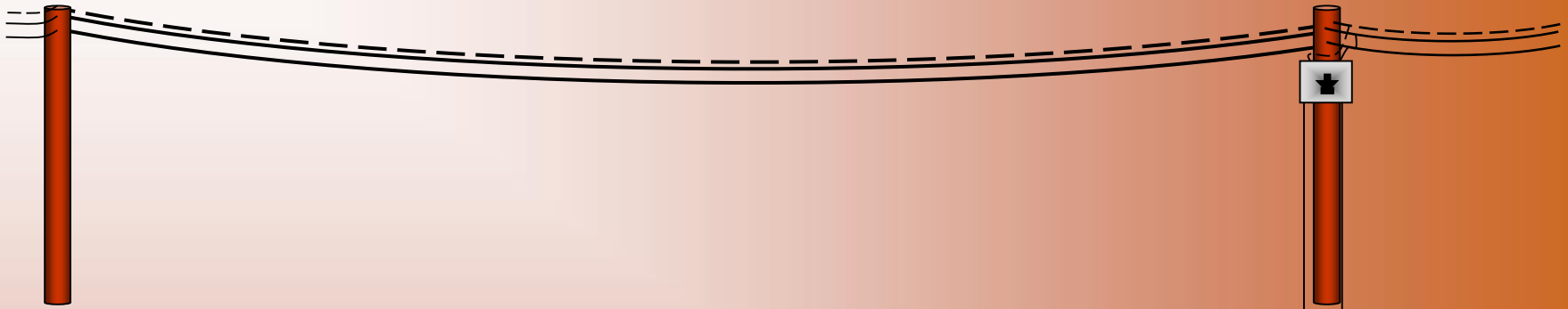
Soil IR Drop in pipe-to-soil Measurement. Note polarity of the voltmeter and terminal connection to the pipe. Current flow is away from the pipeline.

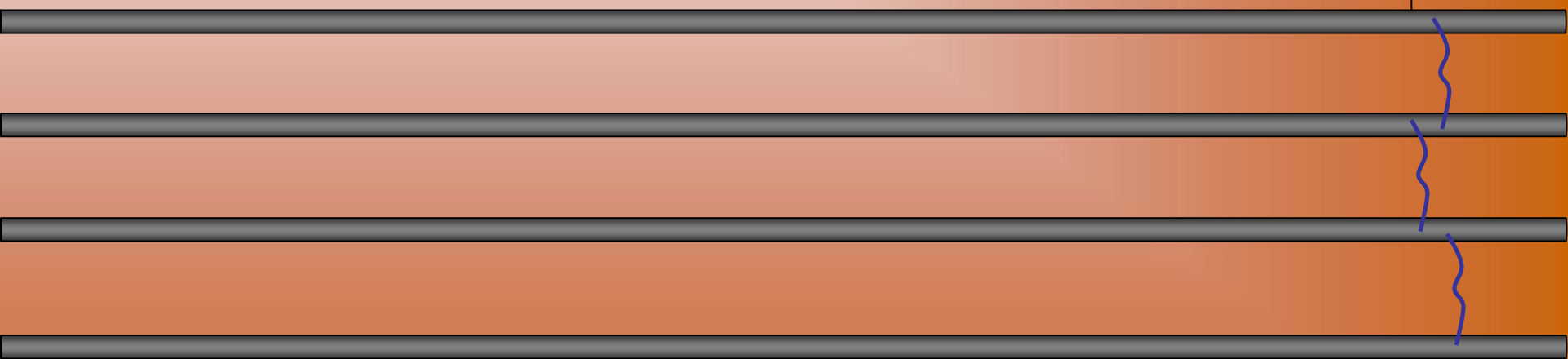
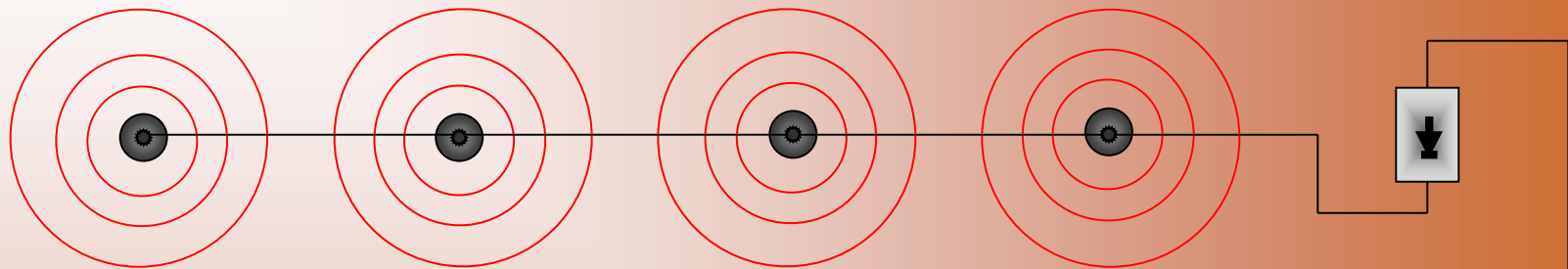


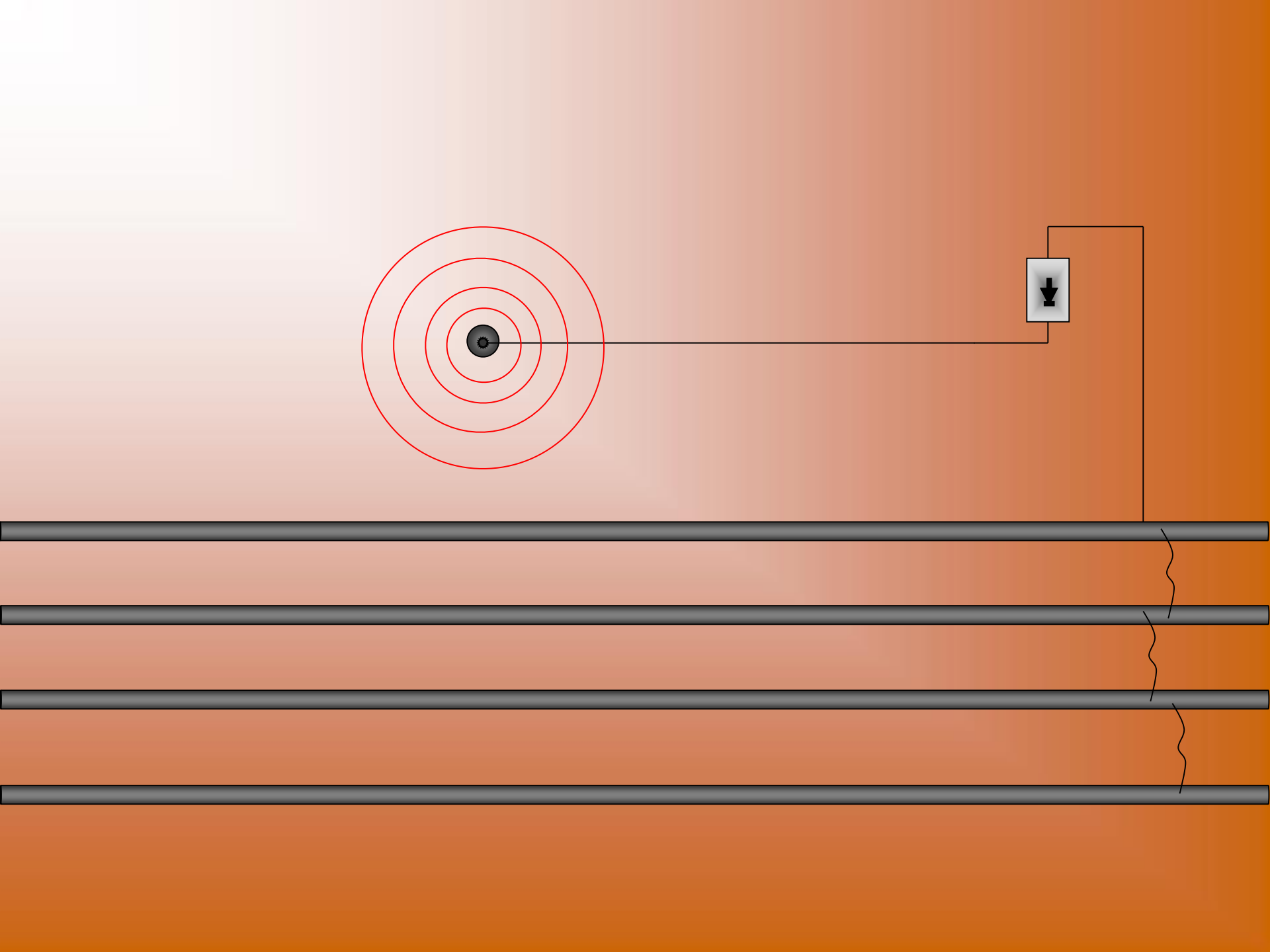


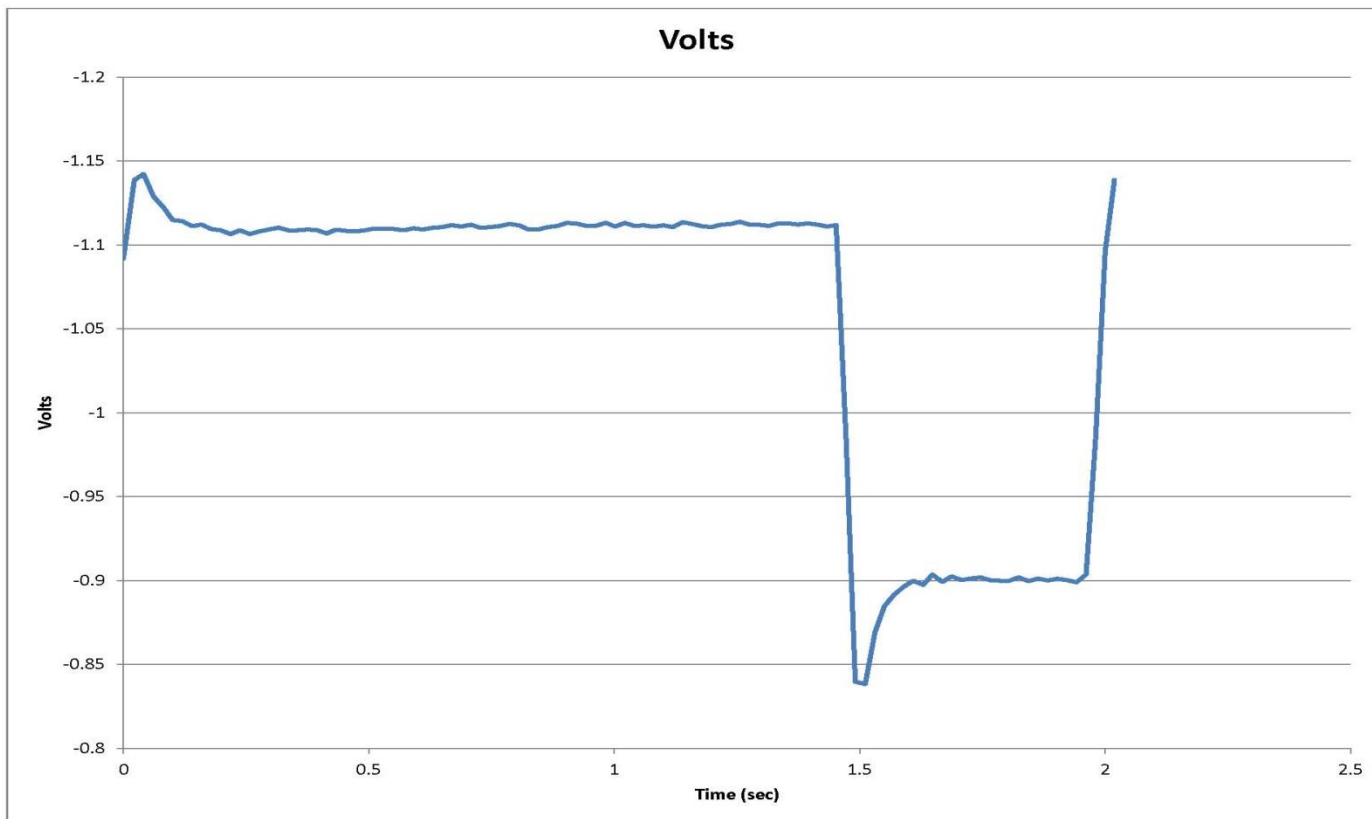
Multiple Gas Mains

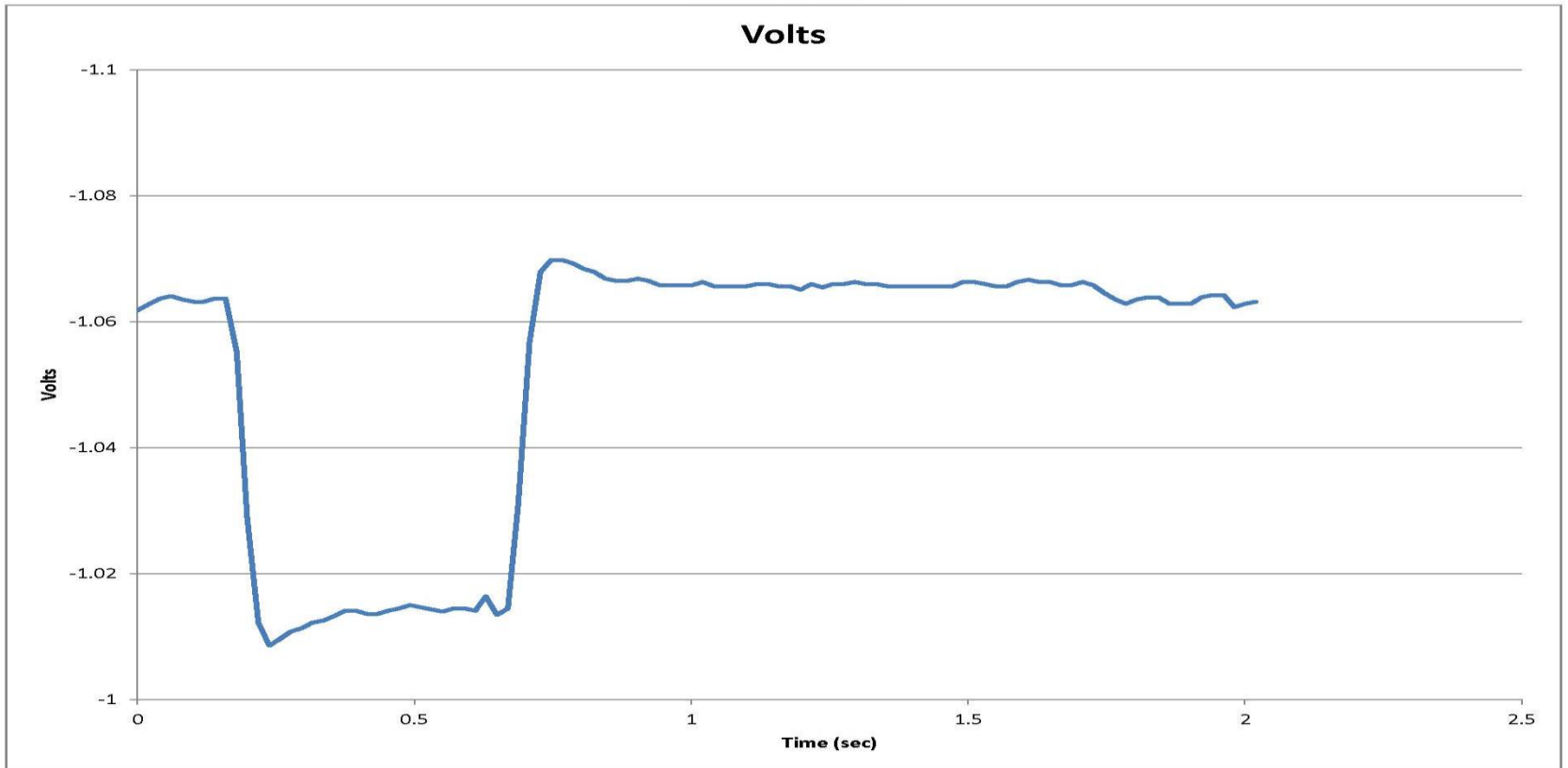


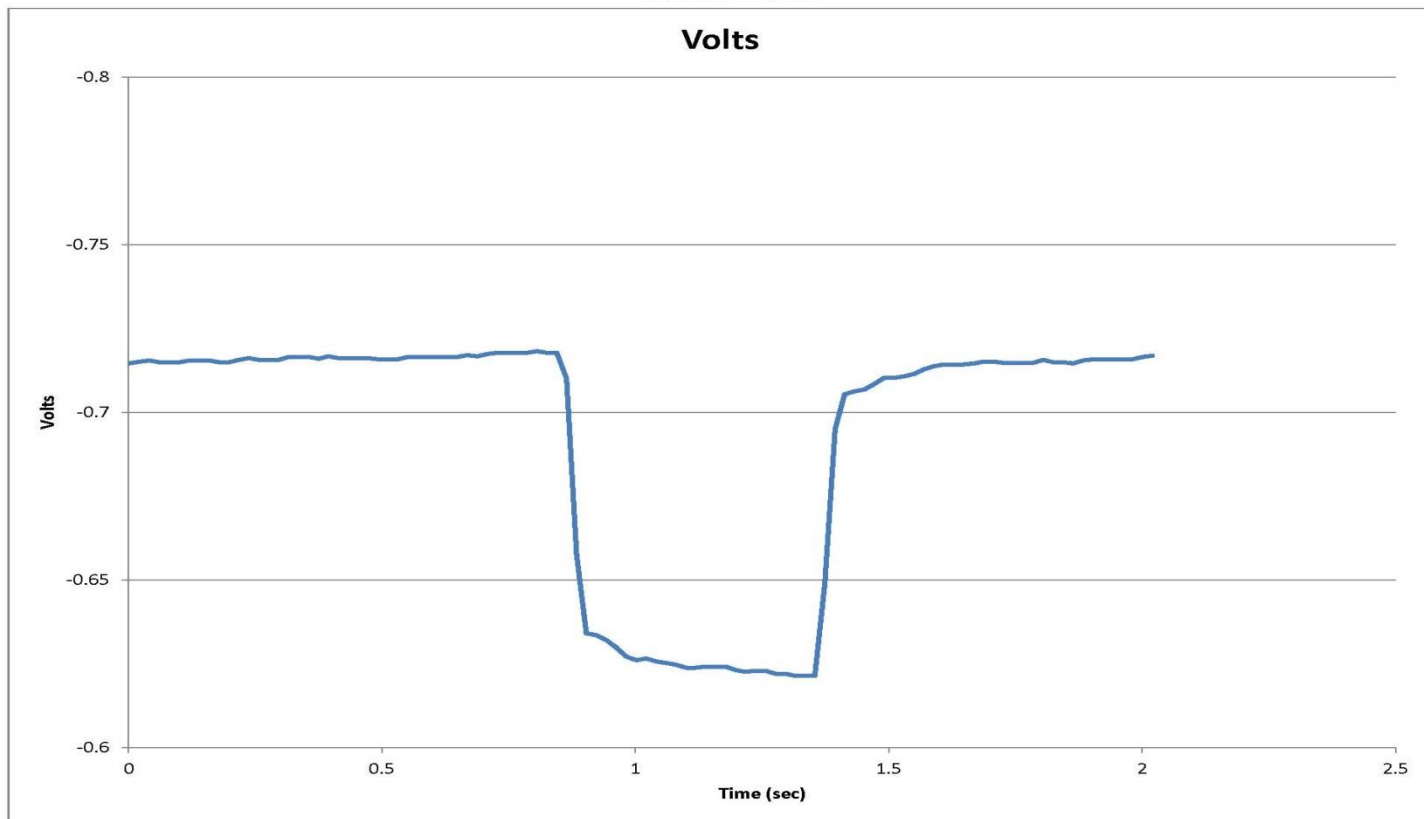


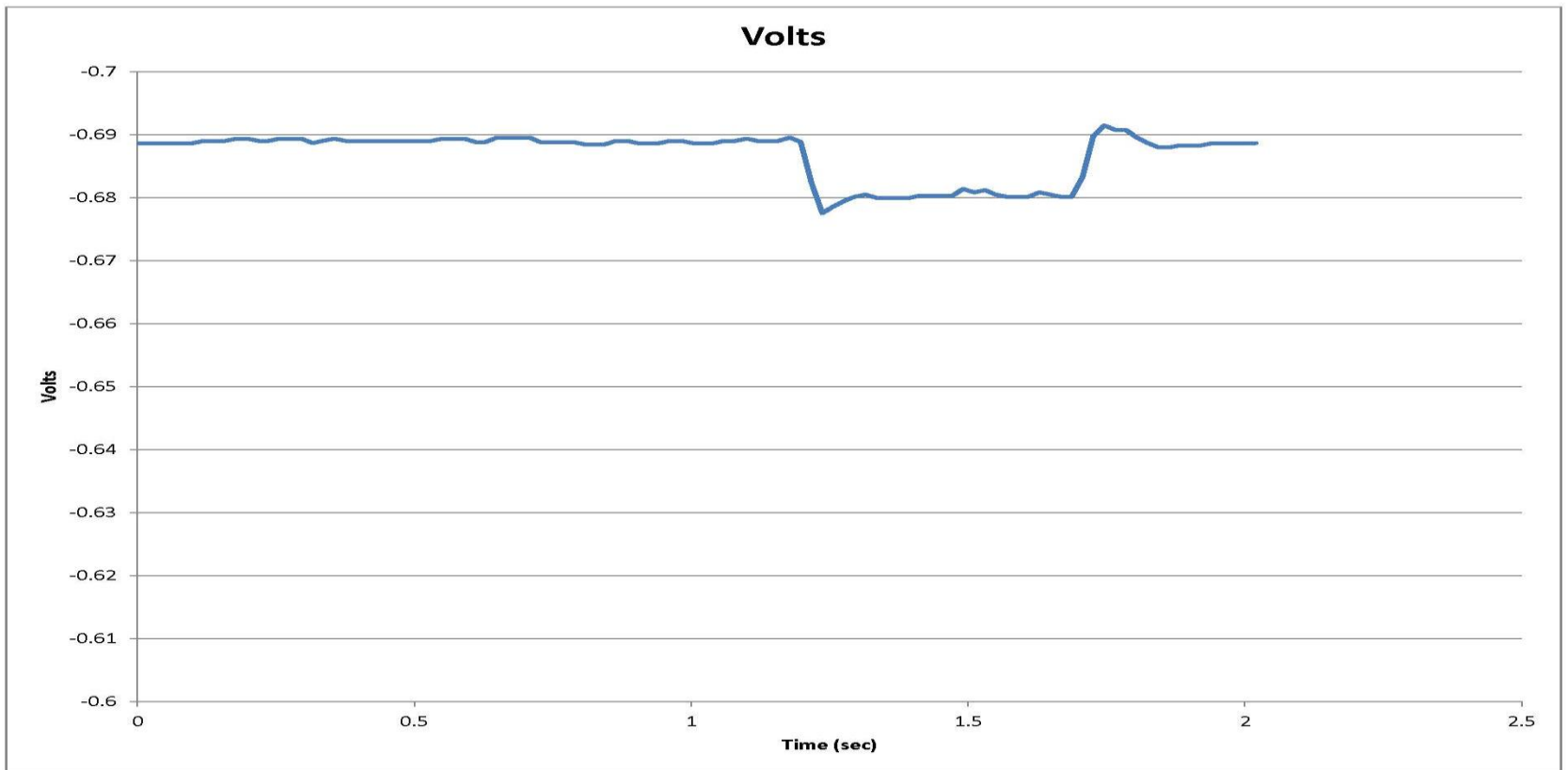




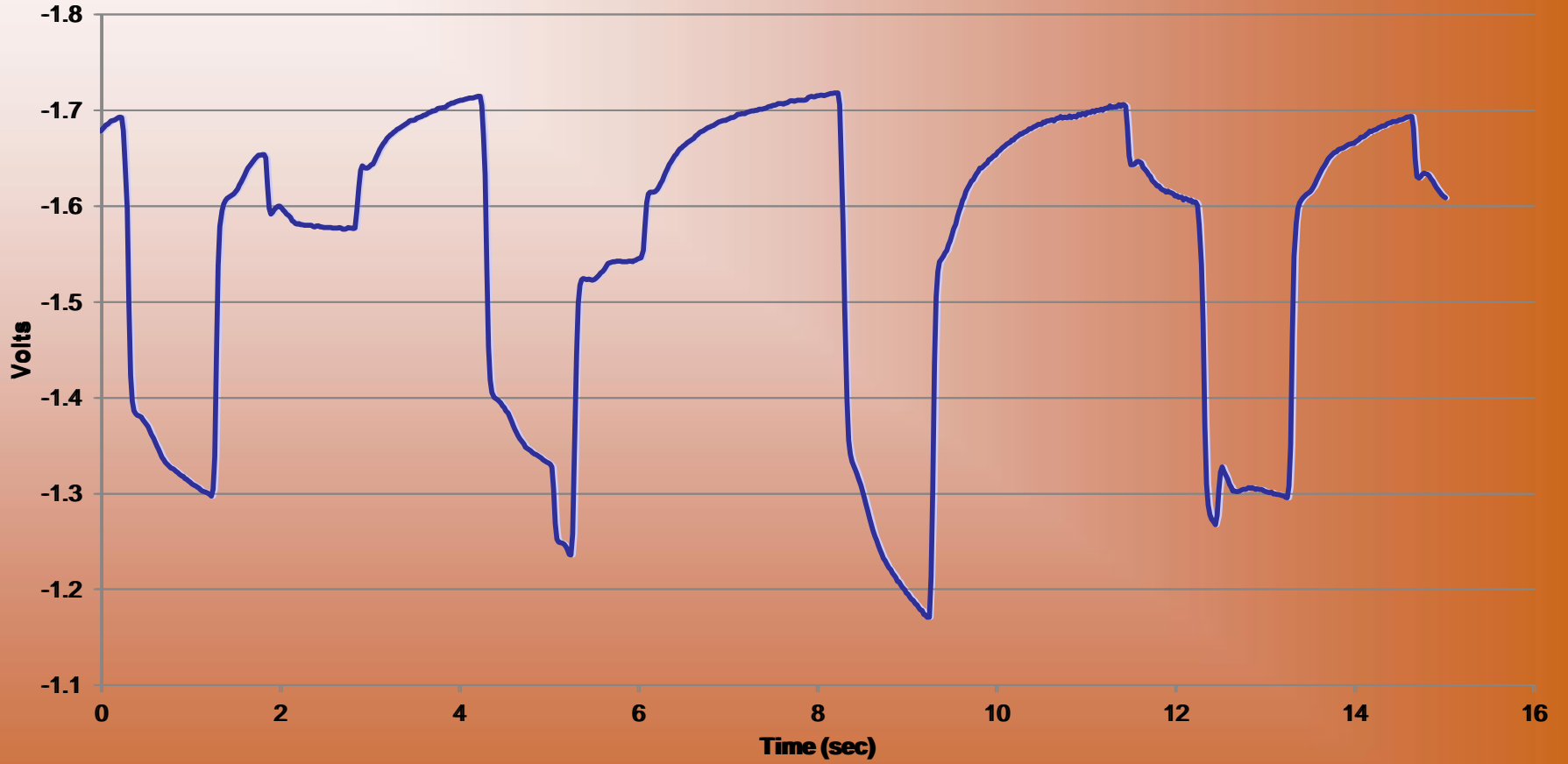








Volts



CIS – The Classics

- Large Dip in the On and Off measurements
- Dip in the On measurement but not in the Off measurement
- Large Rise in both the On and Off measurements
- High Off measurement

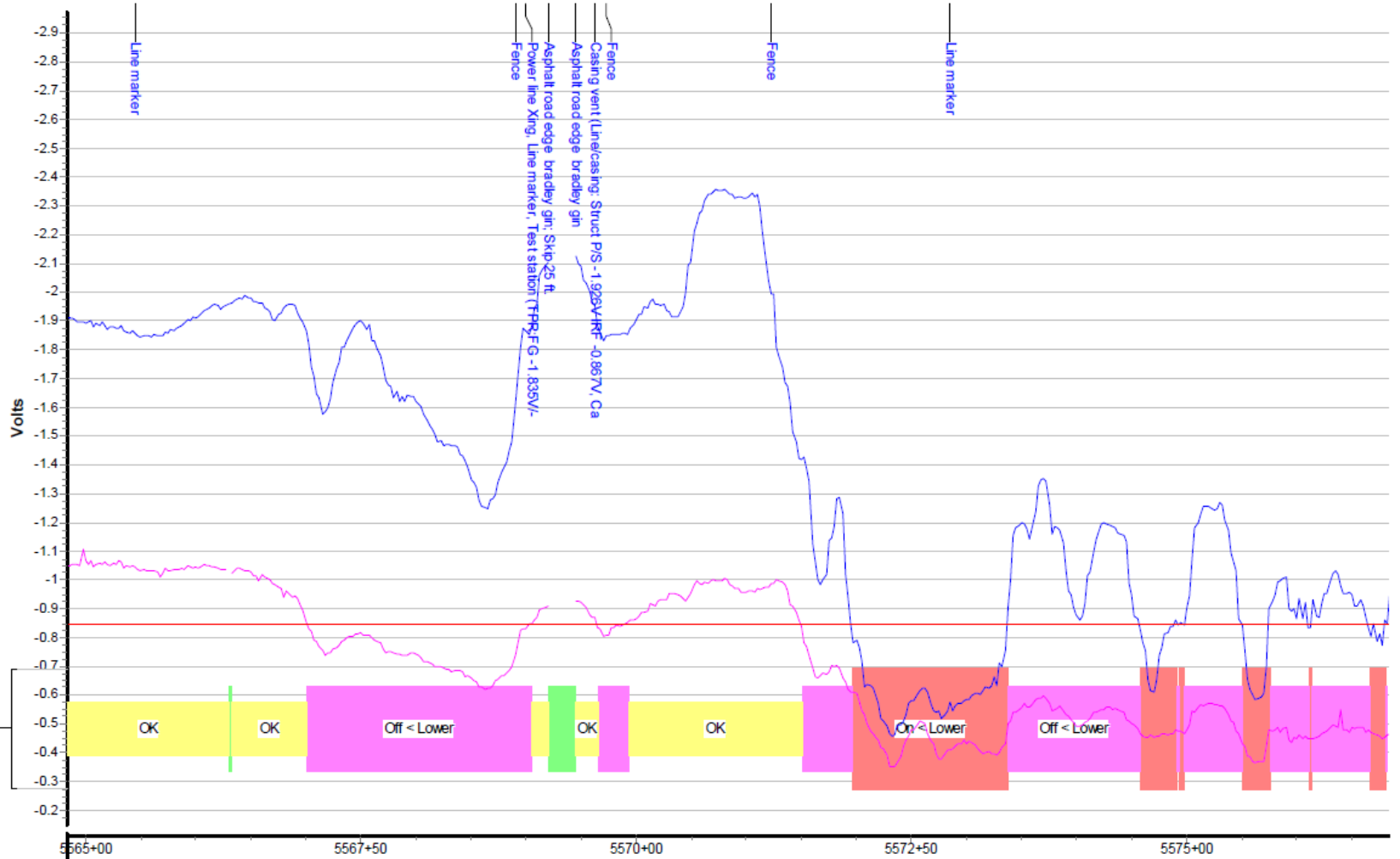
CIS – The Not So Classics

- Off measurement higher than the On
- Reasonable On measurement with very low Off measurement
- Reasonable On measurement with very high Off measurement
- Positive measurements

CIS – The Ugly

- Scatter
- Spikes
- Flat Line
- Gaps

CIS
 — CIS On
 — CIS Off
 — -850 mV Line

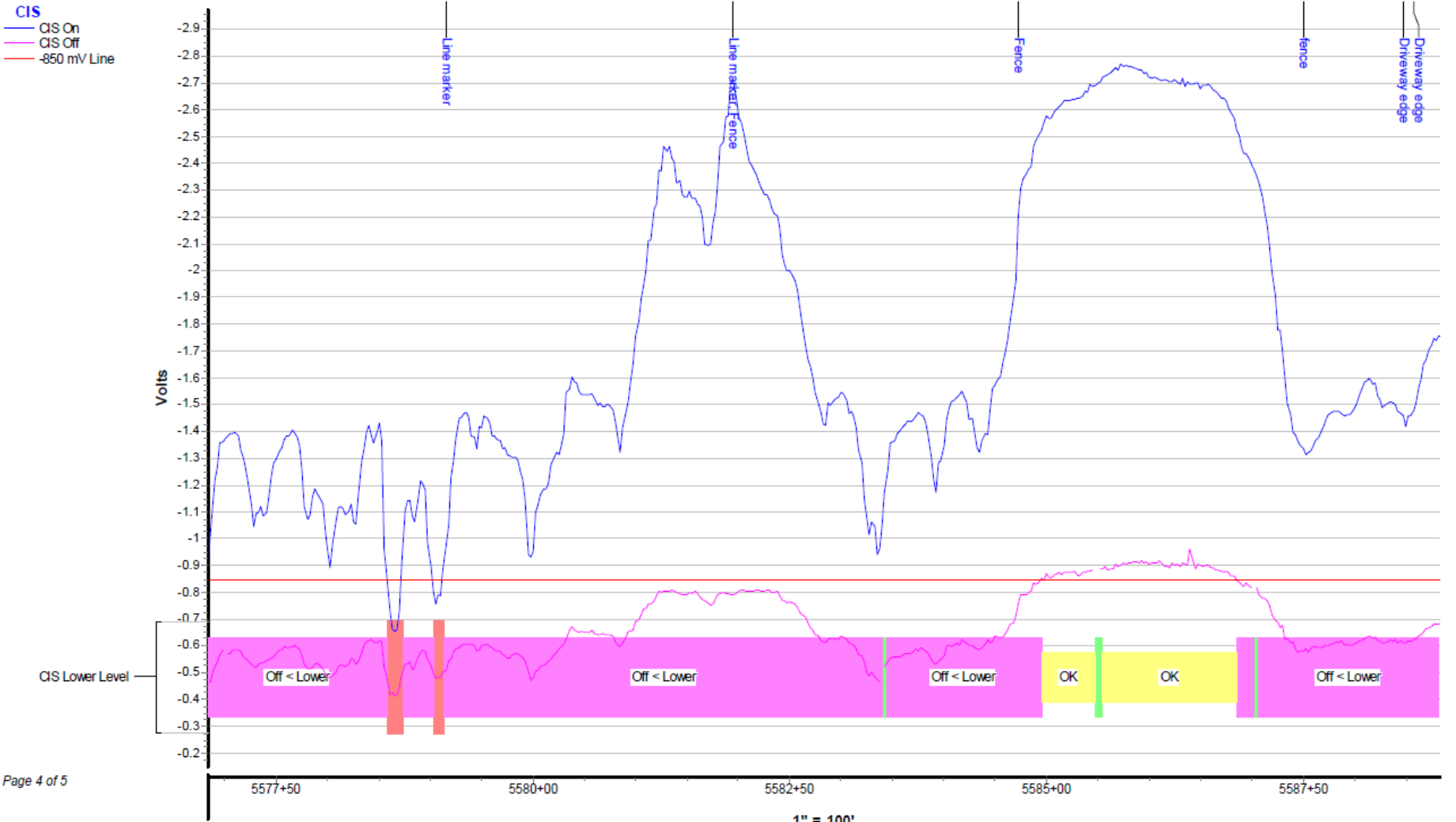


CIS – Casings

- Difference between the Pipe On measurements and Casing On measurements
- Difference between the Off measurements
- Difference in the amount of Shift between Pipe to Soil measurements and Casing to Soil measurements
- Shorted casings
- Electrolytic Coupling

CIS – Metal IR

- Goal of Interrupted CIS (Zero on the Off)
- Negative mV On measurement
- Negative mV Off measurement
- Positive On or Off measurement
- High On measurement
- High Off measurement
- Positive On and Negative Off
- Increasing measurements between two test stations





CIS data collection solutions

- Fluctuating voltages due to interfering sources of dc including foreign rectified systems, dc rail, welding shops, deep mines, HVDC, and others.
 - Conduct survey at less interfering times (i.e. nighttime).
 - Use stationary data logger to record voltage measurements that can be correlated with mobile CIS data and adjusted accordingly.
- AC shock hazard in electrical transmission ROW.
 - Follow all safety precautions including long sleeves and safety gloves when picking up wire.
- AC meter interference.
 - Use a meter with better interference rejection capabilities.

What data is most important?

- IT DEPENDS!
 - What is the history of the line?
 - Leaks, Stray Current, TPI, dis-bondment, soils, CP, etc.
 - Are there shorts or bonds in the system?
 - Is there new coating followed by old coating?
 - Are there paved or very rocky areas?
 - How many rectifiers are in the system to be surveyed?
 - How many foreign crossings are there?
 - And the list goes on...

What data is most important?

(cont.)

Multiple applicable tools are key to having a good ECDA indirect inspection survey.

While the rule only requires two inspection techniques it is almost always required at some locations to have a minimum of three.

Knowing where your holidays are AND the cathodic protection state are key in making informed decisions about External Corrosion.

Soils can also be of added value where the tools need supplemental data for support.

Of course any and all Pre-Assessment data is crucial to success.

Summary

- Combining data and tools are crucial to proper identification of possible external corrosion.
- Other items in the indirect inspections such as depth of cover and foreign crossings should be included in the analysis at indications to look for Third Party Damage.
- If one tool shows an indication and the others do not, it should be verified as to why this occurred and not ignored.
- Coating is not perfect. Therefore if you find nothing you need to find out why the tools didn't work, resolve the issues and resurvey where necessary.
- All local conditions must be considered before deciding what indications are monitored, scheduled and immediate.

QUESTIONS?

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