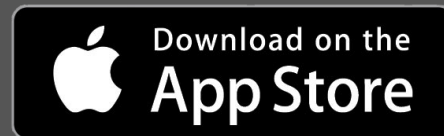


Cathodic Protection Calculator

Mobile App



ell
ENGINEERING

Cathodic Protection Calculator

Cathodic Protection Testing

Reference Electrodes

Soil Resistivity

Structures

Anodes

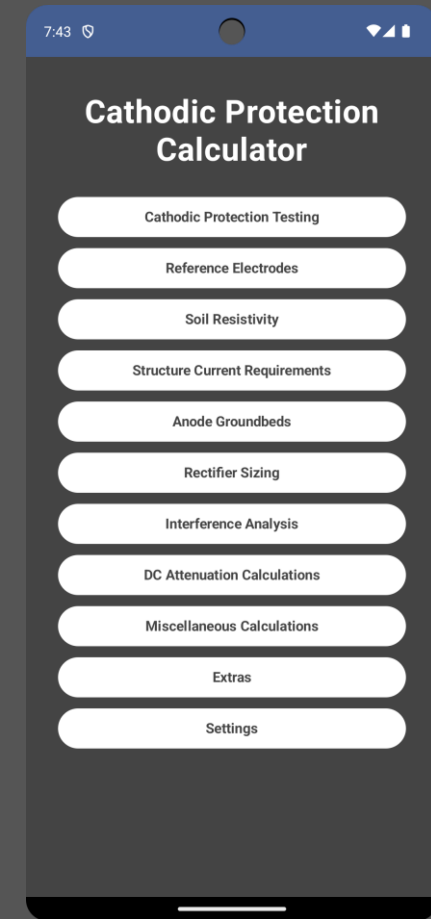
Rectifier Sizing

Interference Analysis

DC Attenuation Calculations

Miscellaneous Calculations

Extras



Cathodic Protection Testing

Current Shunt Conversions

Current Requirement Testing

Current Span Testing

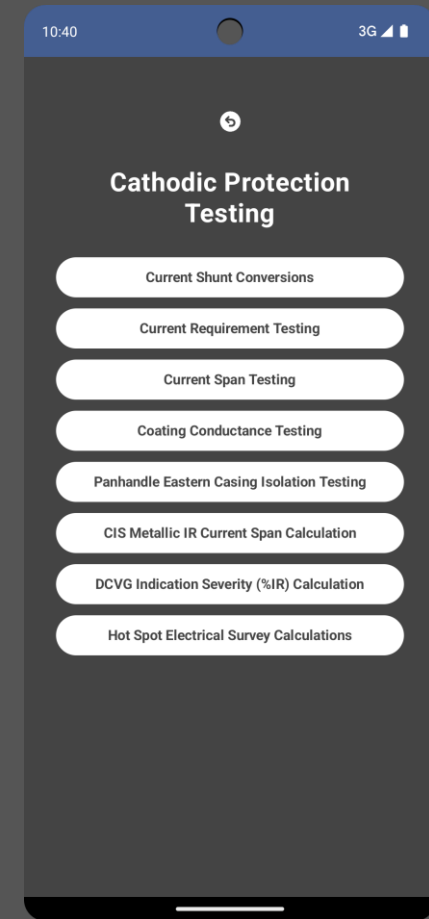
Coating Conductance Testing

Panhandle Eastern Casing Isolation Testing

CIS Metallic IR Current Span Calculation

DCVG Indication (%IR) Calculation

Hot Spot Electrical Survey Calculations



Current Shunt Conversions

Options: Resistance ¹, Voltage/Amperage ²

Inputs

Measured Voltage

Shunt Resistance Rating ¹

Shunt Voltage Rating ²

Shunt Amperage Rating ²

Units

Volts, Millivolts

Ohms, Milliohms

Volts, Millivolts

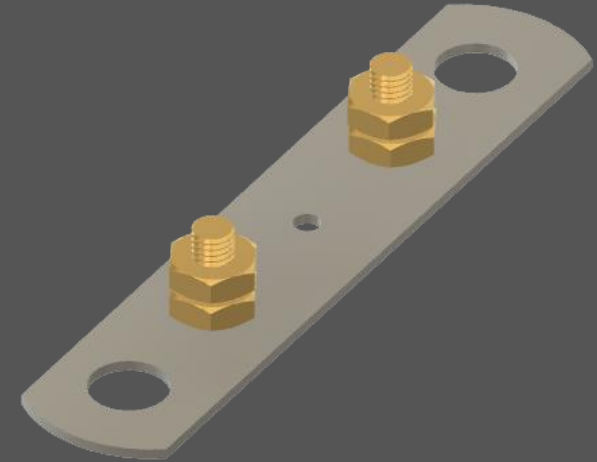
Amps, Milliamps

Outputs

Measured Current

Units

Amps, Milliamps



Current Requirement Testing

Inputs

Test Current, C

Native Potential, V

Polarized Potential, V

Outputs

Required Current
(To Meet 100 mV Polarization Criteria)

Required Current
(To Meet -850 mV Polarized Potential Criteria)

Units

Amps, Milliamps

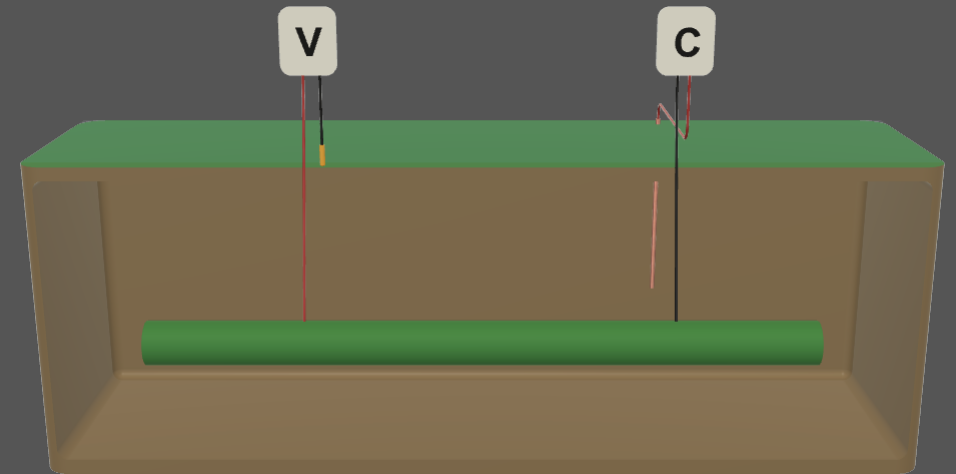
Volts, Millivolts

Volts, Millivolts

Units

Amps, Milliamps

Amps, Milliamps



Current Span Testing

Inputs

Test Span Current, C

Span Voltage With Current Off, V

Span Voltage With Current On, V

Outputs

Span Resistance

Units

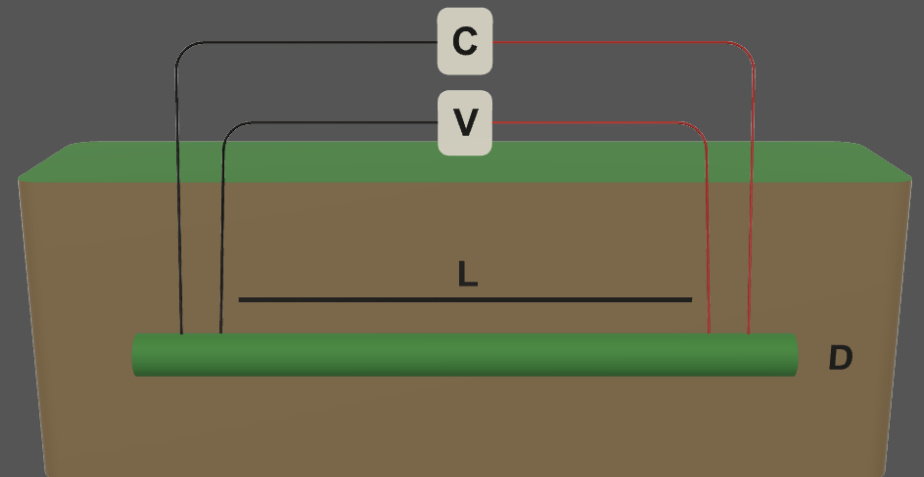
Amps, Milliamps

Volts, Millivolts

Volts, Millivolts

Units

Ohms, Milliohms



Coating Conductance Testing

Inputs

Current Span Test Station 1

Current 1 On, I1

Current 1 Off, I1

Potential 1 with Current On, V1

Potential 1 with Current Off, V1

Current Span Test Station 2

Current 2 On, I2

Current 2 Off, I2

Potential 2 with Current On, V2

Potential 2 with Current Off, V2

Soil Resistivity

Pipeline Dimensions

Pipeline Length, L

Pipeline Diameter, D

Outputs

Coating Conductance
(With Respect to 1000 ohm-cm Soil Resistivity)

Units

Amps, Milliamps

Amps, Milliamps

Volts, Millivolts

Volts, Millivolts

Amps, Milliamps

Amps, Milliamps

Volts, Millivolts

Volts, Millivolts

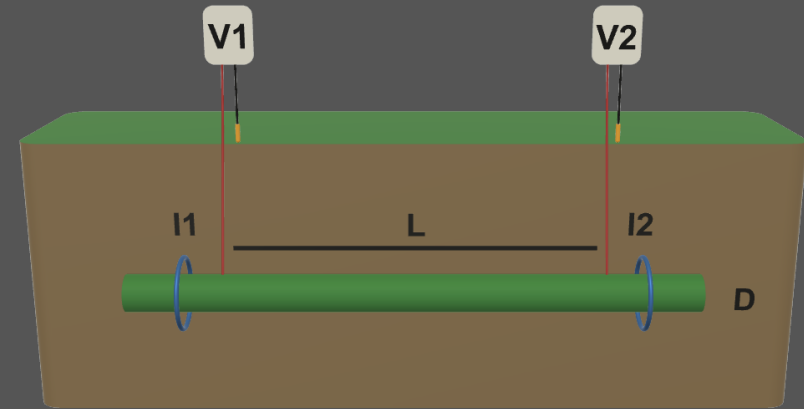
Ohm-Centimeter, Ohm-Foot

Meters, Feet

Centimeters, Inches

Units

Siemens/Meter², Siemens/Foot²



AVERAGE SPECIFIC COATING CONDUCTANCE (@ 1000 OHM-CM)		
Long Pipelines with Few Fittings	g' or $1/r'$ (siemens/ft ²)	g' or $1/r'$ (siemens/m ²)
Quality of Work		
Excellent	< 1×10^{-5}	< 1×10^{-4}
Good	1×10^{-5} to 5×10^{-5}	1×10^{-4} to 5×10^{-4}
Fair	5×10^{-5} to 1×10^{-4}	5×10^{-4} to 1×10^{-3}
Poor	> 1×10^{-4}	> 1×10^{-3}
Bare Pipe (2" to 12") (5 cm to 30 cm)	4×10^{-3} to 2×10^{-2}	4×10^{-2} to 2×10^{-1}
Gas or Water Distribution with Many Fittings		
Quality of Work		
Excellent	< 5×10^{-5}	< 5×10^{-4}
Good	5×10^{-5} to 1×10^{-4}	5×10^{-4} to 1×10^{-3}
Fair	1×10^{-4} to 5×10^{-4}	1×10^{-3} to 5×10^{-3}
Poor	> 5×10^{-4}	> 5×10^{-3}
Bare Pipe (2" to 12") (5 cm to 30 cm)	4×10^{-3} to 2×10^{-2}	4×10^{-2} to 2×10^{-1}

Panhandle Eastern Casing Isolation Testing

Inputs

Test Current, C

Pipeline Potential With Current Off, V1

Pipeline Potential With Current On, V1

Casing Potential With Current Off, V2

Casing Potential With Current On, V2

Outputs

Resistance

(If Resistance \leq 0.08 ohms, metallic short exists)

Units

Amps, Milliamps

Volts, Millivolts

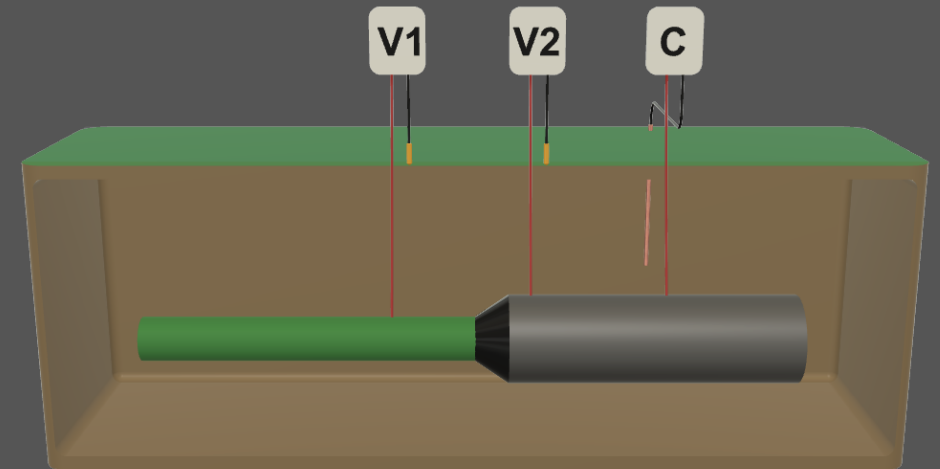
Volts, Millivolts

Volts, Millivolts

Volts, Millivolts

Units

Ohms, Milliohms



CIS Metallic IR Current Span Calculation

Options: Carbon Steel

Inputs

Metallic IR
(Far Ground – Near Ground)

Distance Between Test Stations, L

Pipeline Outer Diameter, D

Pipeline Thickness, t

Outputs

Span Current

Units

Volts, Millivolts

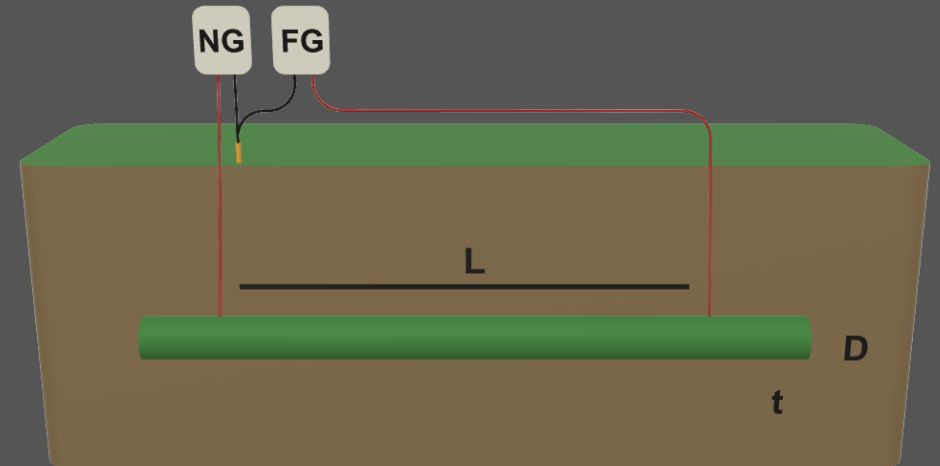
Meters, Feet

Centimeters, Inches

Centimeters, Inches

Units

Amps, Milliamps



DCVG Indication Severity (%IR) Calculation

Inputs

Over the Line to Remote Earth Potential, V_a

DCVG Signal Amplitude to Remote Earth at Test Station 1, V_1

DCVG Signal Amplitude to Remote Earth at Test Station 2, V_2

Distance Measurement of Test Station 1
(This is 0 at the beginning of the survey)

Distance Measurement of Test Station 2, d_2

Distance Measurement of Indication from Test Station 1, d_1

Outputs

Indication Severity (%IR)

Units

Volts, Millivolts

Volts, Millivolts

Volts, Millivolts

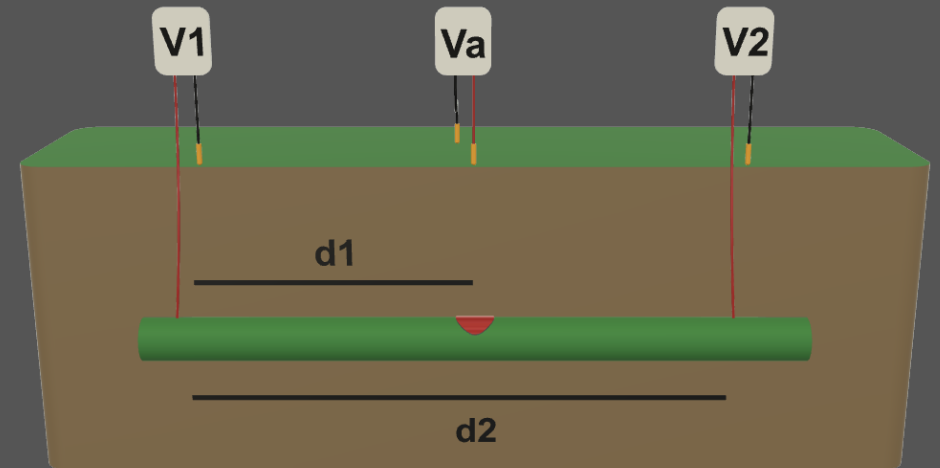
Meters, Feet

Meters, Feet

Meters, Feet

Units

Percent (%)



Anomaly Rating	% IR Measurement
Noteworthy	0% IR to 15% IR
Minor	16% IR to 35% IR
Moderate	36% IR to 60% IR
Severe	61% IR to 100% IR

Hot Spot Electrical Survey Calculations

Options: Carbon Steel

Inputs

Largest Negative Side Drain Potential, V

Soil Resistivity at Pipe Depth

Pipe Depth, d

Estimated Anodic Surface Area, SA
(1 ft² surface area normally used as default)

Outputs

Corrosion Current
(Corrosion Factor)

Corrosion Rate

Units

Volts, Millivolts

Ohm-Centimeter, Ohm-Foot

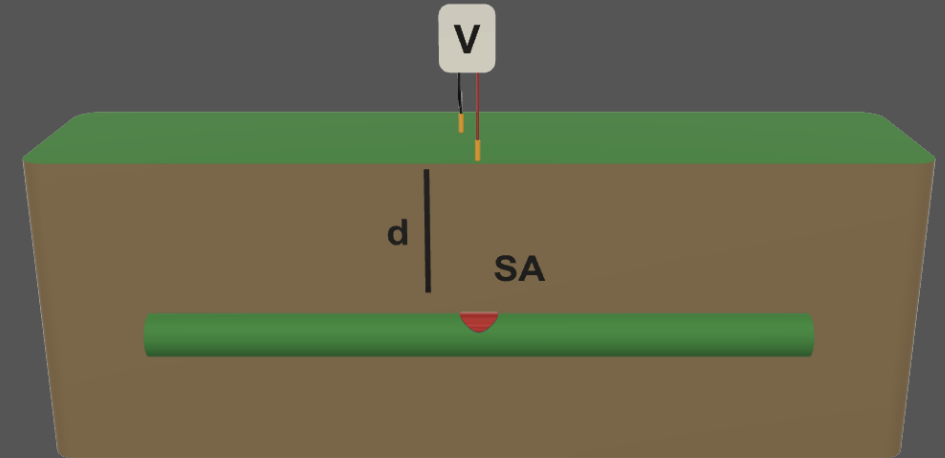
Meters, Feet

Meter², Feet²

Units

Milliamps

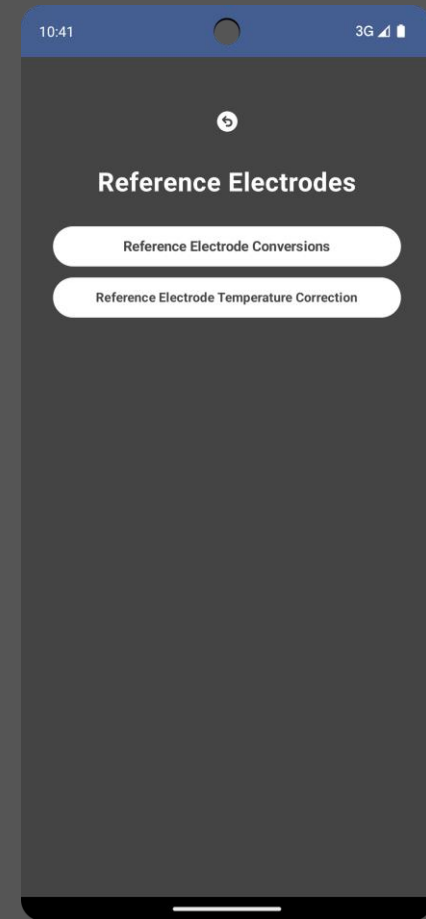
Millimeters/Year, Mils/Year



Reference Electrodes

Reference Electrode Conversions

Reference Electrode Temperature Correction



Reference Electrode Conversions

Inputs

Convert From (Reference Electrode Type):
CuSO₄, AgCl, Zinc, Calomel, Palladium

Potential Measurement

Units

Volts, Millivolts

Outputs

Convert To (Reference Electrode Type):
CuSO₄, AgCl, Zinc, Calomel, Palladium

Potential Measurement

Units

Volts, Millivolts



Reference Electrode Temperature Correction

Options: To 25° Celsius, From 25° Celsius

Inputs

Units

Reference Electrode Type:

CuSO₄, Zinc, Calomel, AgCl(SJ), AgCl(LJ Sat), AgCl(LJ 0.1N)

Potential Measurement

Volts, Millivolts

Reference Electrode Temperature

Celsius, Fahrenheit

Outputs

Units

Potential Measurement

Volts, Millivolts



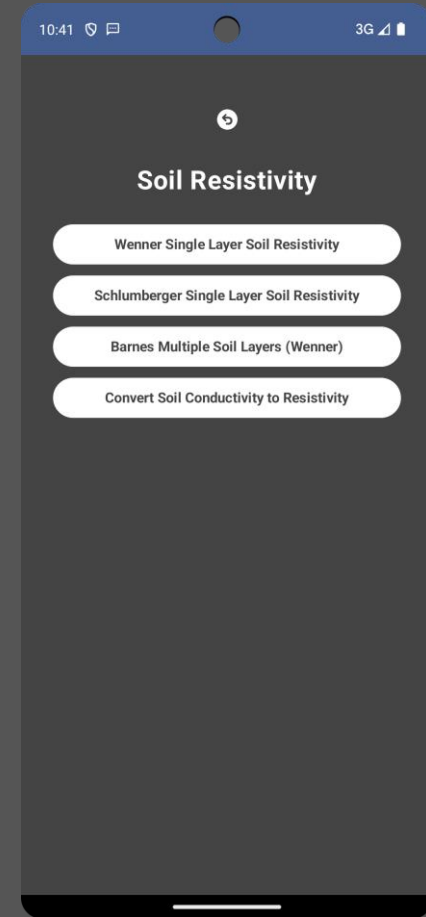
Soil Resistivity

Wenner Single Layer Soil Resistivity

Schlumberger Single Soil Layer Soil Resistivity

Barnes Multiple Soil Layers (Wenner)

Convert Soil Conductivity to Resistivity



Wenner Single Layer Soil Resistivity

Options: Resistance ¹ , Voltage/Amperage ²

Inputs

Resistance ¹

Voltage ²

Amperage ²

Pin Spacing, a

Units

Ohms, Milliohms

Volts, Millivolts

Amps, Milliamps

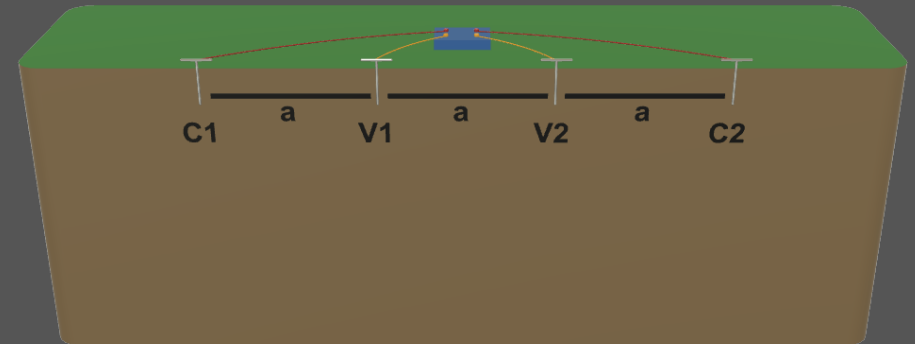
Meters, Feet

Outputs

Soil Resistivity

Units

Ohm-Centimeter, Ohm-Foot



Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	Essentially Non-Corrosive
10,000 to 20,000	Mildly Corrosive
5,000 to 10,000	Moderately Corrosive
3,000 to 5,000	Corrosive
1,000 to 3,000	Highly Corrosive
< 1,000	Extremely Corrosive

Schlumberger Single Layer Soil Resistivity

Options: Resistance ¹ , Voltage/Amperage ²

Inputs

Resistance ¹

Voltage ²

Amperage ²

Voltage Pin Spacing, a

Current Pin Spacing, L ($c+a+c$)

Outputs

Soil Resistivity

Units

Ohms, Milliohms

Volts, Millivolts

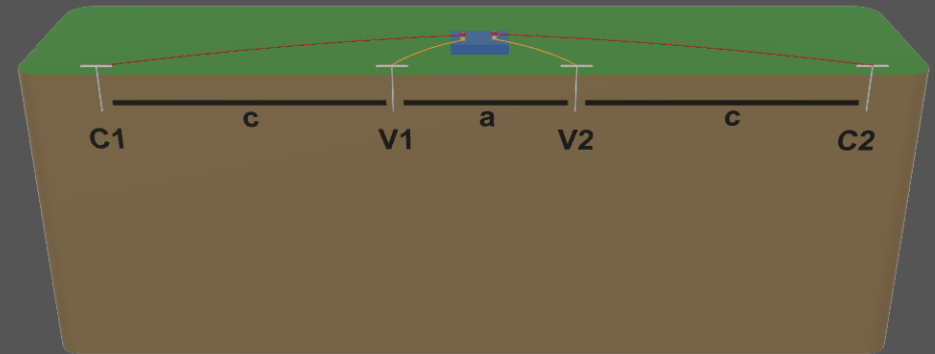
Amps, Milliamps

Meters, Feet

Meters, Feet

Units

Ohm-Centimeter, Ohm-Foot



Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	Essentially Non-Corrosive
10,000 to 20,000	Mildly Corrosive
5,000 to 10,000	Moderately Corrosive
3,000 to 5,000	Corrosive
1,000 to 3,000	Highly Corrosive
< 1,000	Extremely Corrosive

Barnes Multiple Soil Layers (Wenner)

Options: Wenner

Inputs

Layer (n)

Resistance

Pin Spacing, a

Layer (n+1)

Resistance

Pin Spacing, a

Outputs

Layer (n)-(n+1) Resistivity

Units

Ohms, Milliohms

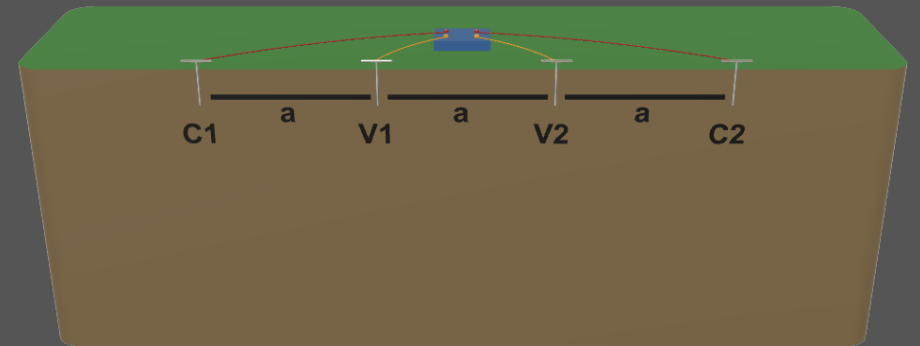
Meters, Feet

Ohms, Milliohms

Meters, Feet

Units

Ohm-Centimeter, Ohm-Foot



Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	Essentially Non-Corrosive
10,000 to 20,000	Mildly Corrosive
5,000 to 10,000	Moderately Corrosive
3,000 to 5,000	Corrosive
1,000 to 3,000	Highly Corrosive
< 1,000	Extremely Corrosive

Convert Soil Conductivity to Resistivity

Options: Soil Resistivity ¹ , Soil Conductivity ²

Inputs

Soil Conductivity ¹

Soil Resistivity ²

Outputs

Soil Resistivity ¹

Soil Conductivity ²

Units

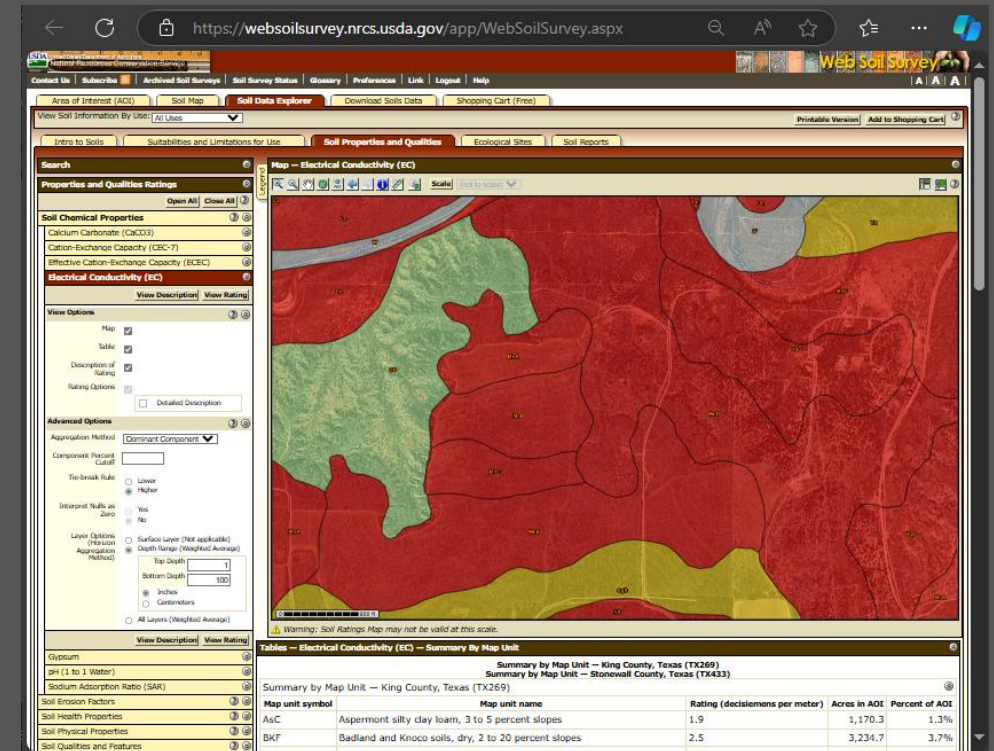
Decisiemens/Meter, Decisiemens/Foot

Ohm-Centimeter, Ohm-Foot

Units

Ohm-Centimeter, Ohm-Foot

Decisiemens/Meter, Decisiemens/Foot



Source: USDA Web Soil Survey website

Structures

Structure Current Requirements

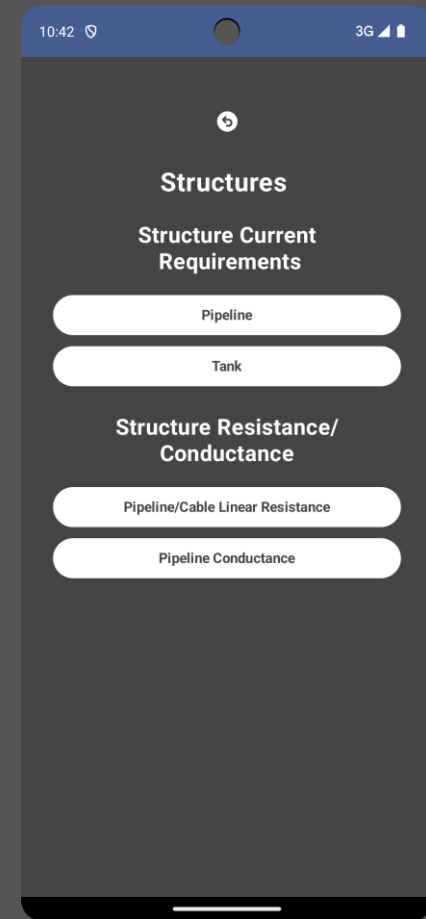
Pipeline

Tank

Structure Resistance/Conductance

Pipeline/Cable Linear Resistance

Pipeline Conductance



Pipeline Current Requirements

Inputs

Current Requirement

Pipeline Length, L

Pipeline Diameter, D

Percent Coating Efficiency

Units

Milliamps/Meter², Milliamps/Foot²

Meters, Feet

Centimeters, Inches

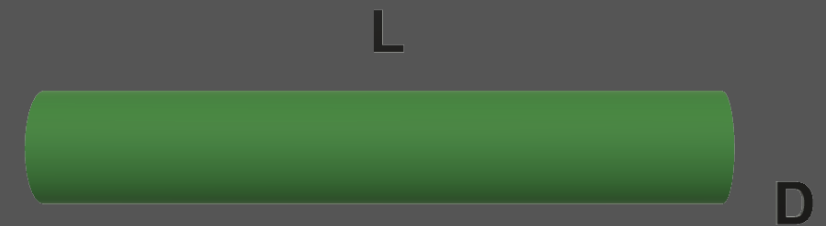
Percent (%)

Outputs

Cathodic Protection Current

Units

Amps, Milliamps



Tank Current Requirements

Inputs

Current Requirement

Tank Height, H

Tank Diameter, D

Percent Coating Efficiency

Units

Milliamps/Meter², Milliamps/Foot²

Meters, Feet

Meters, Feet

Percent (%)

Outputs

Cathodic Protection Current
(Tank Bottom & Shell)

Cathodic Protection Current
(Tank Bottom Only)

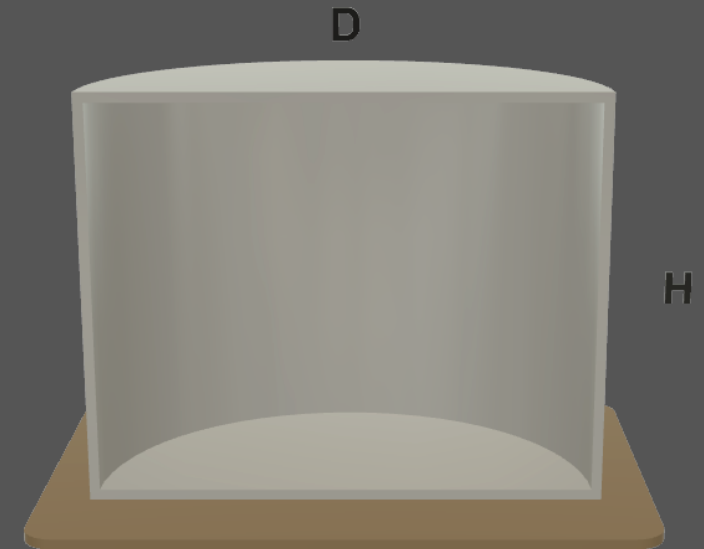
Cathodic Protection Current
(Tank Bottom, Shell & Top)

Units

Amps, Milliamps

Amps, Milliamps

Amps, Milliamps



Pipeline/Cable Linear Resistance

Options: Pipeline/Carbon Steel ¹ , Cable/Copper ²

Inputs

Pipeline Length, L ¹

Pipeline Outer Diameter, D ¹

Pipeline Inner Diameter, D ¹

Cable Length, L ²

Cable Diameter, D ²

Outputs

Resistance

Units

Meters, Feet

Centimeters, Inches

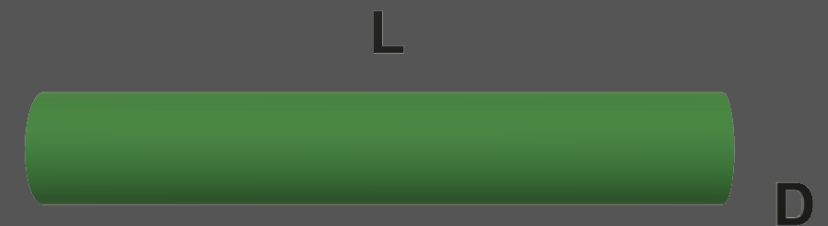
Centimeters, Inches

Meters, Feet

Centimeters, Inches

Units

Ohms, Milliohms



Pipeline Conductance

Inputs

Soil Resistivity

Pipeline Length, L

Pipeline Diameter, D

Pipeline Depth, d

Pipeline Coating Efficiency

Outputs

Conductance (to Remote Earth)

Resistance (to Remote Earth)

Units

Ohm-Centimeters, Ohm-Foot

Meters, Feet

Centimeters, Inches

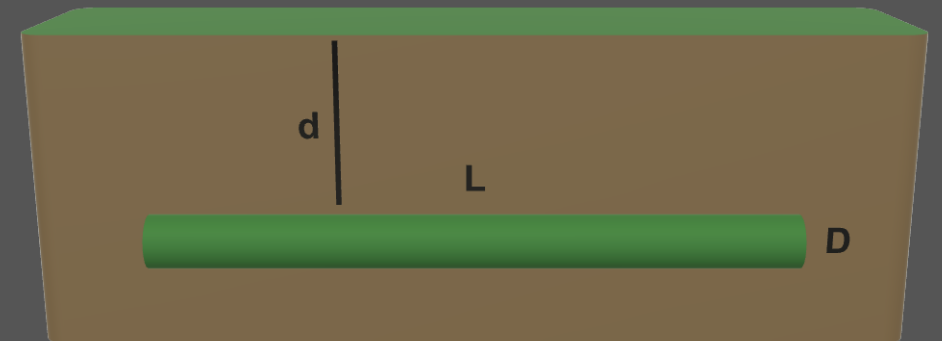
Meters, Feet

Percent (%)

Units

Siemens, Millisiemens

Ohms, Milliohms



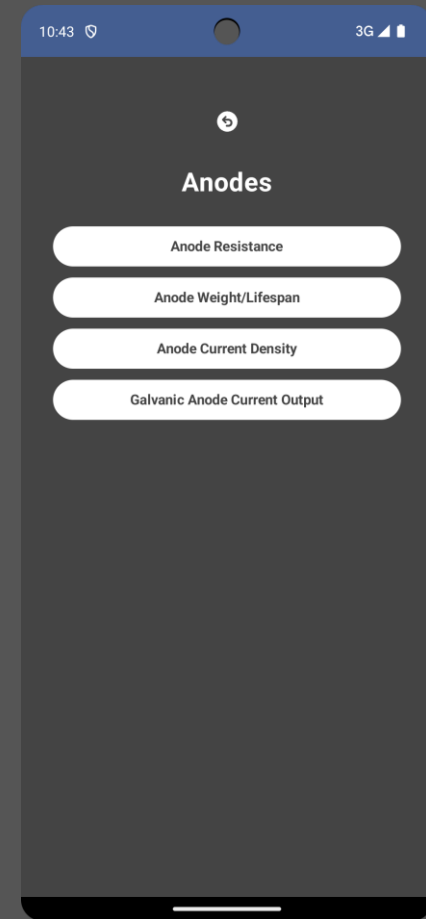
Anodes

Anode Resistance

Anode Weight/Lifespan

Anode Current Density

Galvanic Anode Current Output



Anode Resistance

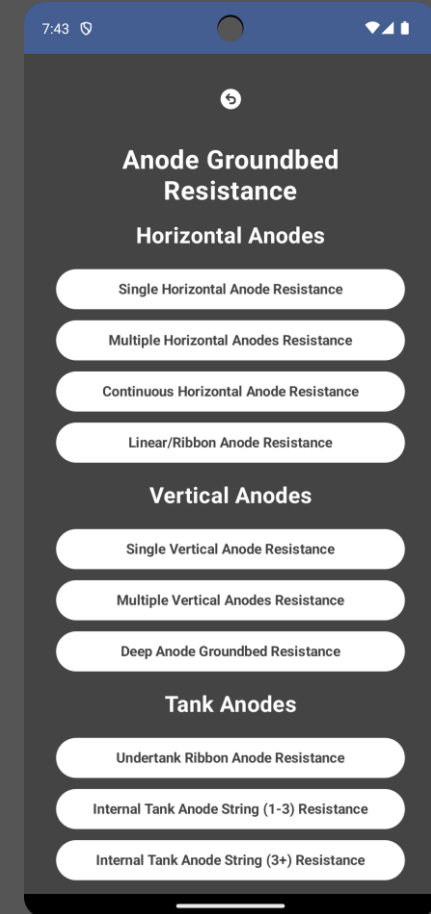
Horizontal Anodes

Vertical Anodes

Tank Anodes

Internal Vessel Anodes

Marine Anodes



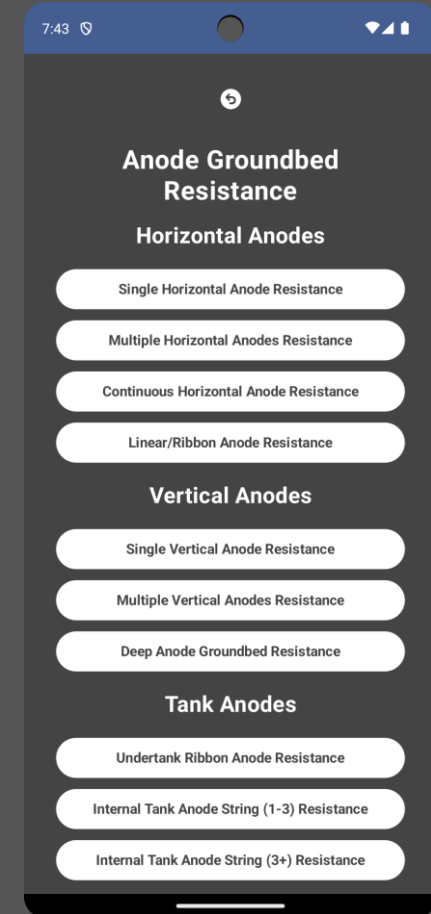
Horizontal Anodes Resistance

Single Horizontal Anode Resistance

Multiple Horizontal Anodes Resistance

Continuous Horizontal Anode Resistance

Linear/Ribbon Anode Resistance



Single Horizontal Anode Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Anode Depth, d

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Outputs

Units

Shallow Depth: Anode Depth \ll Anode Length, Anode Length \gg Anode Diameter

Resistance ¹

Ohms, Milliohms

Soil Resistivity ²

Ohm/Centimeter, Ohm/Foot

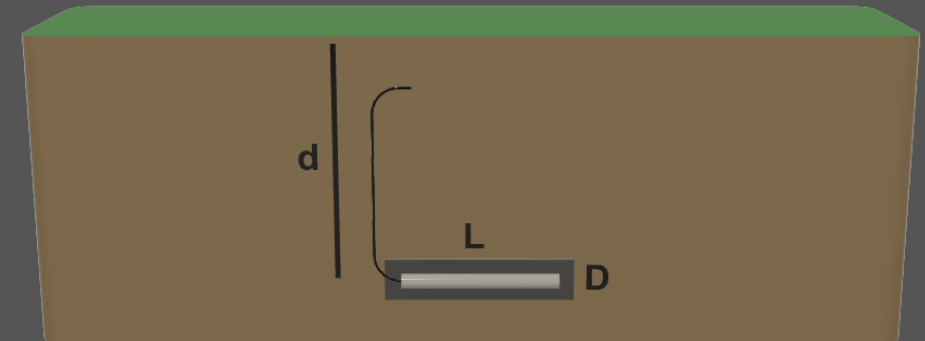
Deep Depth: Anode Depth \gg Anode Length

Resistance ¹

Ohms, Milliohms

Soil Resistivity ²

Ohm/Centimeter, Ohm/Foot



Multiple Horizontal Anodes Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Anode Depth, d

Anode Spacing (Center-to-Center), s

Number of Anodes

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Meters, Feet

Number

Outputs

Units

Shallow Depth: Anode Depth << Anode Length, Anode Length >> Anode Diameter

Resistance ¹

Ohms, Milliohms

Soil Resistivity ²

Ohm/Centimeter, Ohm/Foot

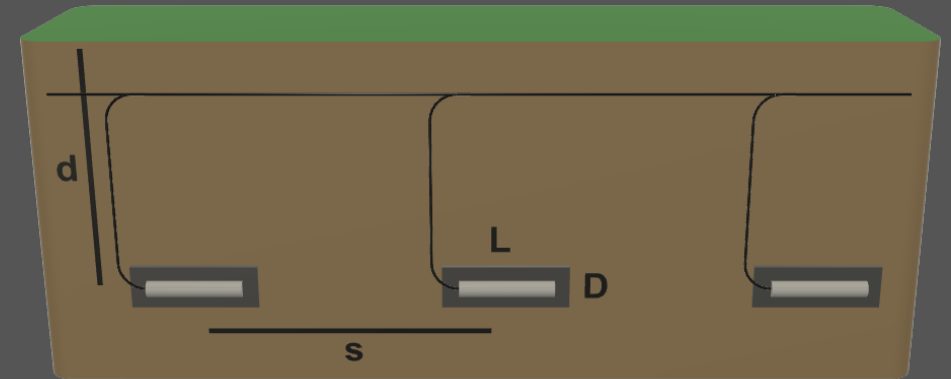
Deep Depth: Anode Depth >> Anode Length

Resistance ¹

Ohms, Milliohms

Soil Resistivity ²

Ohm/Centimeter, Ohm/Foot



Continuous Horizontal Anode Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Anode Depth, d

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Outputs

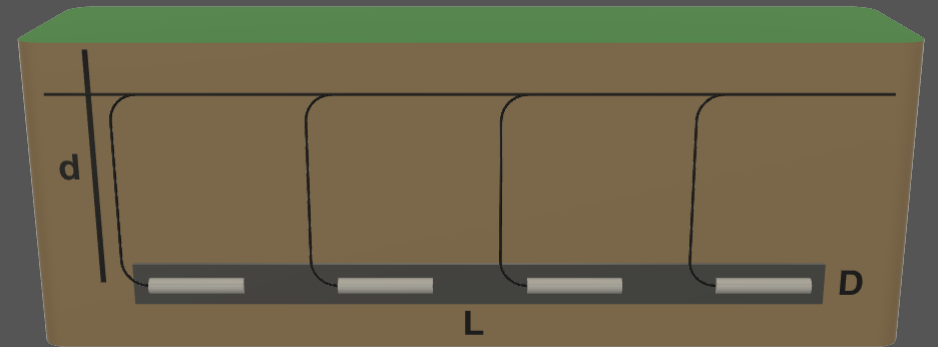
Resistance ¹

Soil Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Linear/Ribbon Anode Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Anode Depth, d

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Outputs

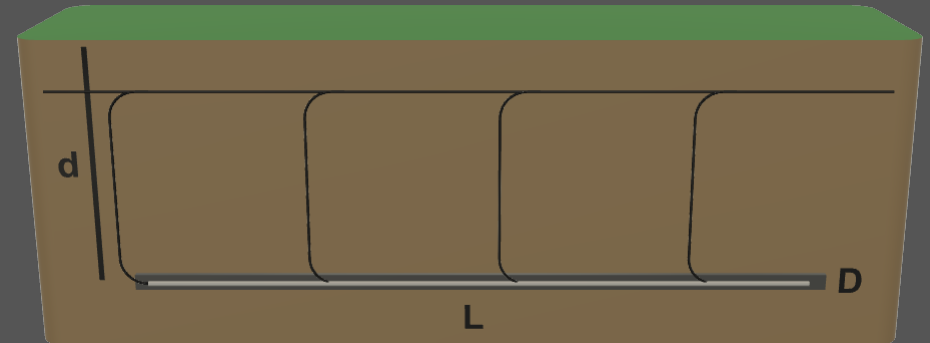
Resistance ¹

Soil Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot

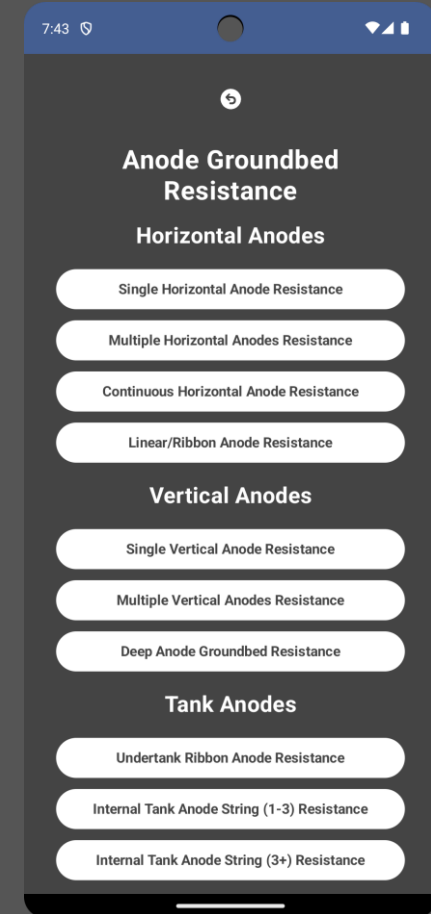


Vertical Anodes Resistance

Single Vertical Anode Resistance

Multiple Vertical Anodes Resistance

Deep Anode Groundbed Resistance



Single Vertical Anode Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Outputs

Shallow Depth

Resistance ¹

Soil Resistivity ²

Deep Depth: Anode Depth >> Anode Length

Resistance ¹

Soil Resistivity ²

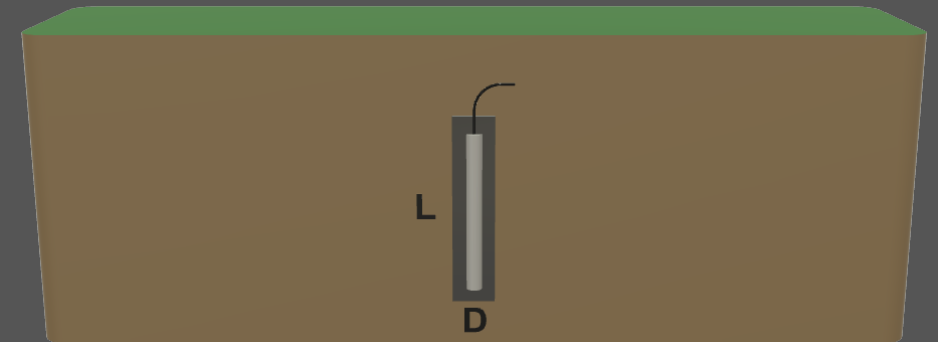
Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Multiple Vertical Anodes Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Anode Depth, d

Anode Spacing (Center-to-Center), s

Number of Anodes

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Meters, Feet

Number

Outputs

Units

No Crowding Effect: Anode Spacing >> Anode Length

Resistance ¹

Ohms, Milliohms

Soil Resistivity ²

Ohm/Centimeter, Ohm/Foot

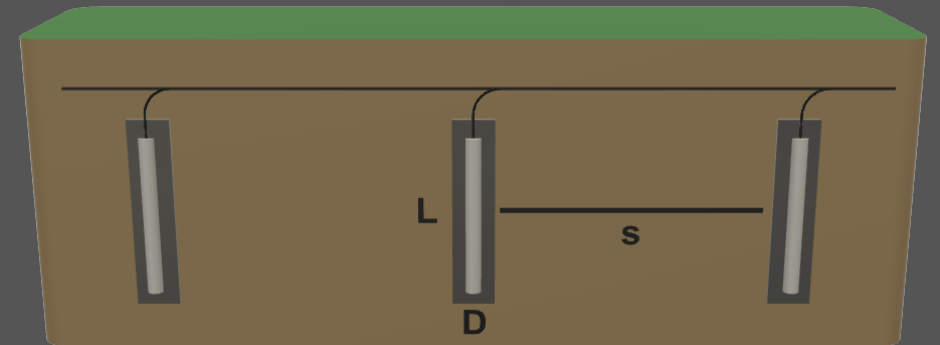
*Crowding Effect: Anode Spacing < 10 * Anode Length*

Resistance ¹

Ohms, Milliohms

Soil Resistivity ²

Ohm/Centimeter, Ohm/Foot



Deep Anode Groundbed Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Backfill Length, L

Anode Backfill Diameter, D

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Outputs

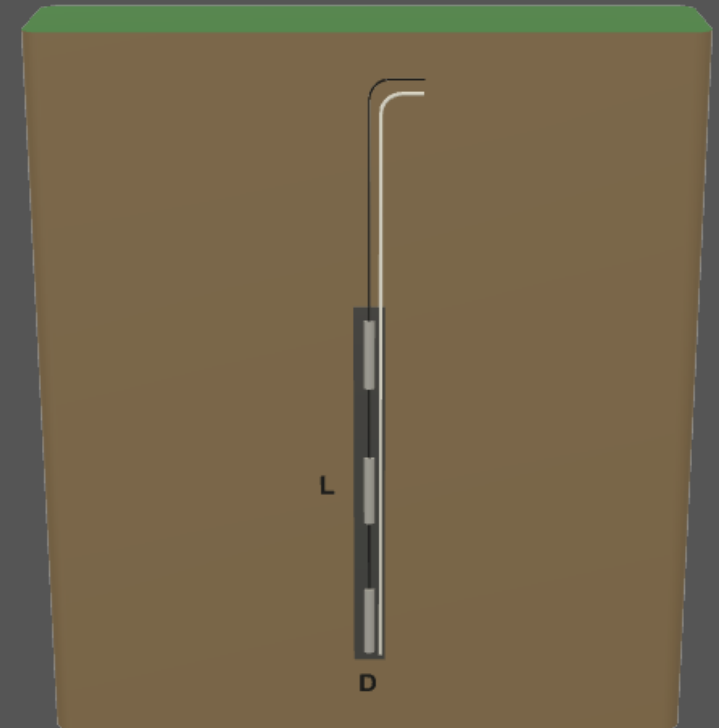
Resistance ¹

Soil Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot

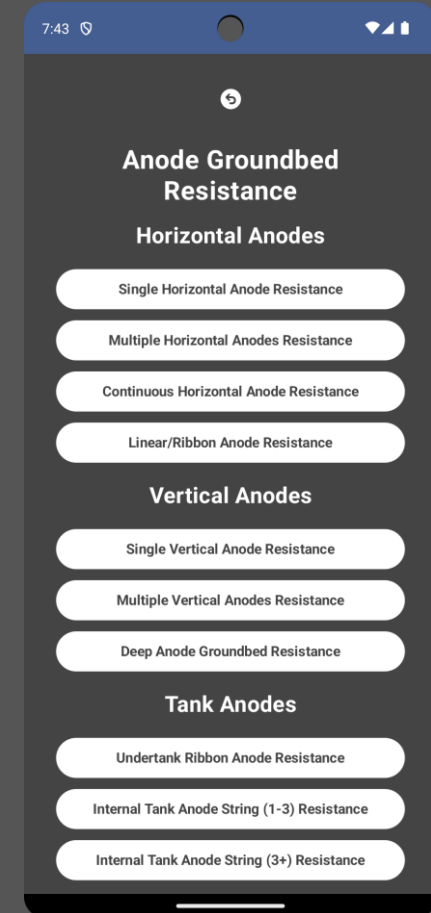


Tank Anodes Resistance

Undertank Ribbon Anode Resistance

Internal Tank Anode String (1-3) Resistance

Internal Tank Anode String (3+) Resistance



Undertank Ribbon Anode Resistance

Options: Resistance ¹ , Soil Resistivity ²

Inputs

Soil Resistivity ¹

Resistance ²

Anode Length, L

Anode Diameter, D

Anode to Tank Bottom Distance, d

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Outputs

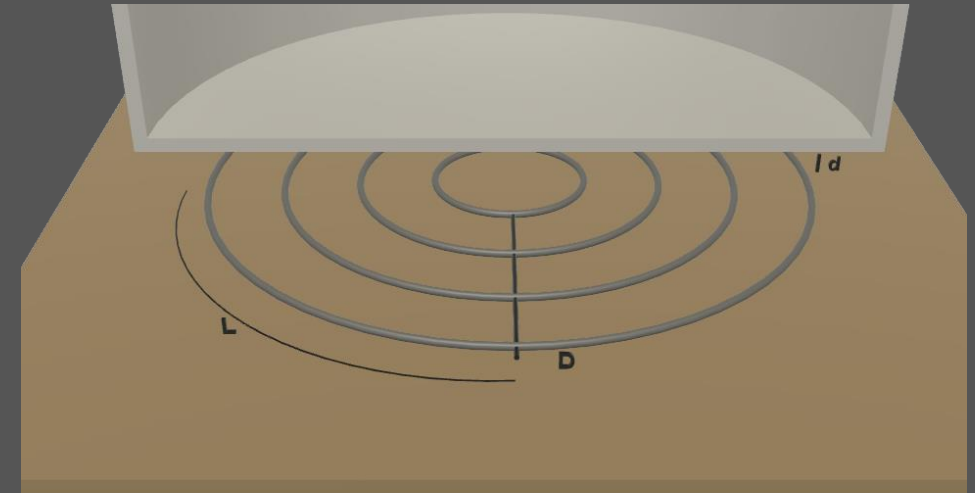
Resistance ¹

Soil Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Internal Tank Anode String (1-3) Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Length, L

Anode Diameter, D

Tank Diameter, d

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

Outputs

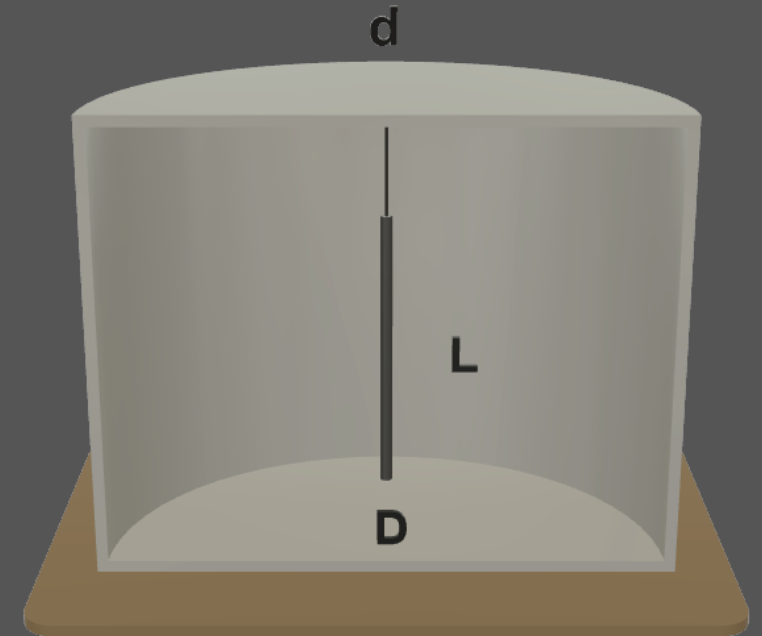
Resistance ¹

Liquid Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Internal Tank Anode String (3+) Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Length, L

Diameter of Anode String Array, D

Tank Diameter, d

Anode Number Correction Factor

Resistance Corrosion Factor

[Use if (Anode Length/Anode Diameter) < 100]

Outputs

Resistance ¹

Liquid Resistivity ²

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Meters, Feet

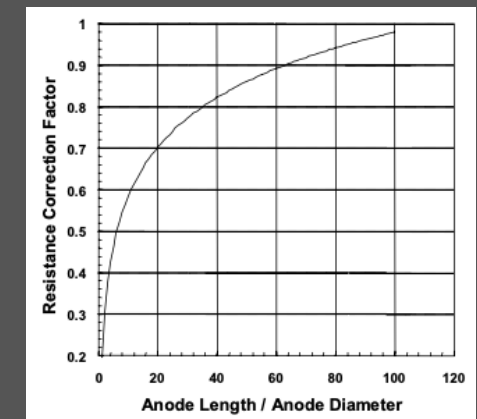
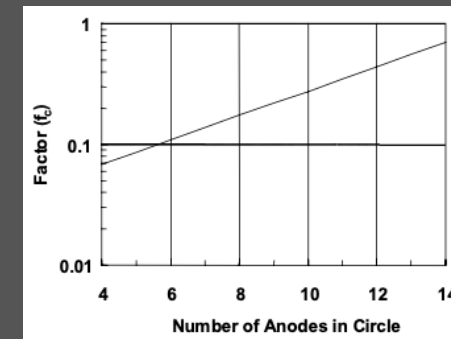
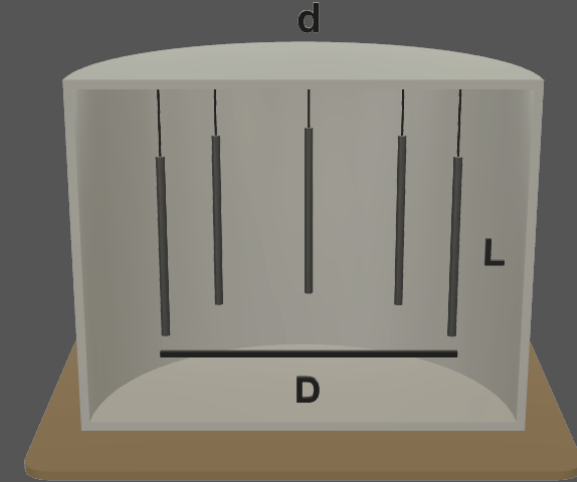
Number

Number

Units

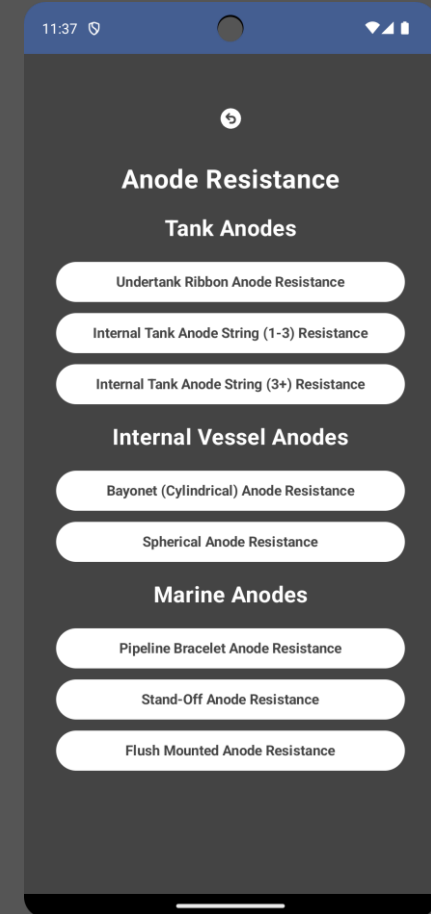
Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Internal Vessel Anodes Resistance

Bayonet (Cylindrical) Anode Resistance
Spherical Anode Resistance



Bayonet (Cylindrical) Anode Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Length, L

Anode Diameter, D

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Outputs

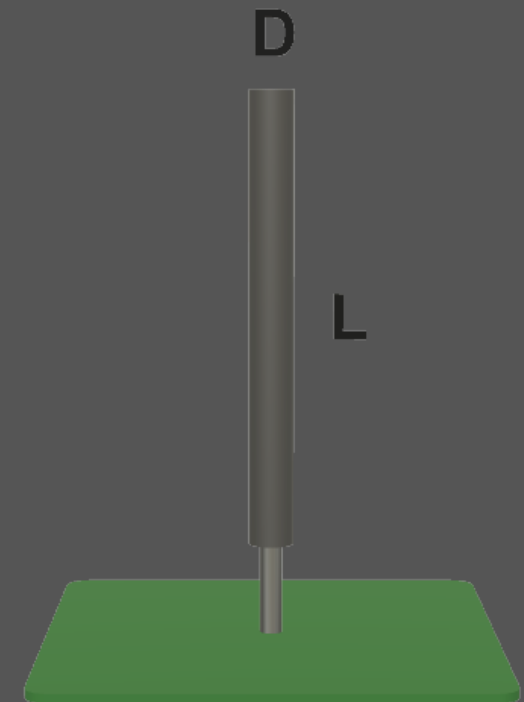
Resistance ¹

Liquid Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Spherical Anode Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Diameter, D

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Centimeters, Inches

Outputs

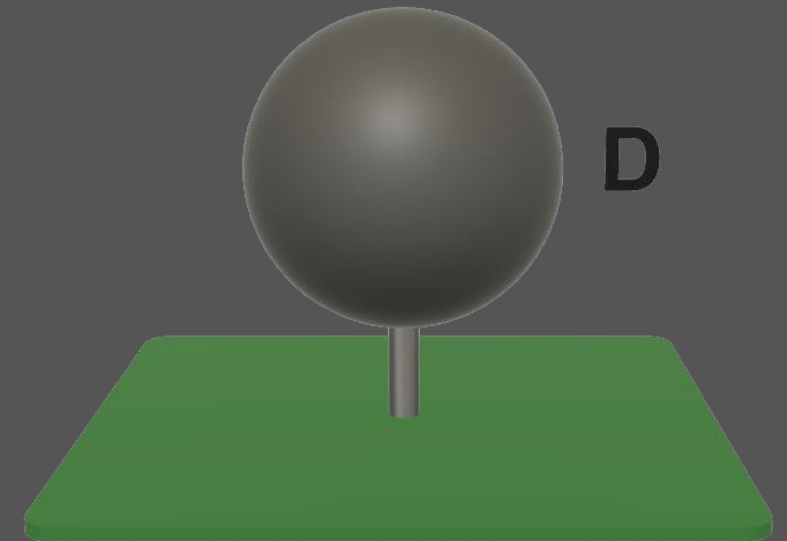
Resistance ¹

Liquid Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot

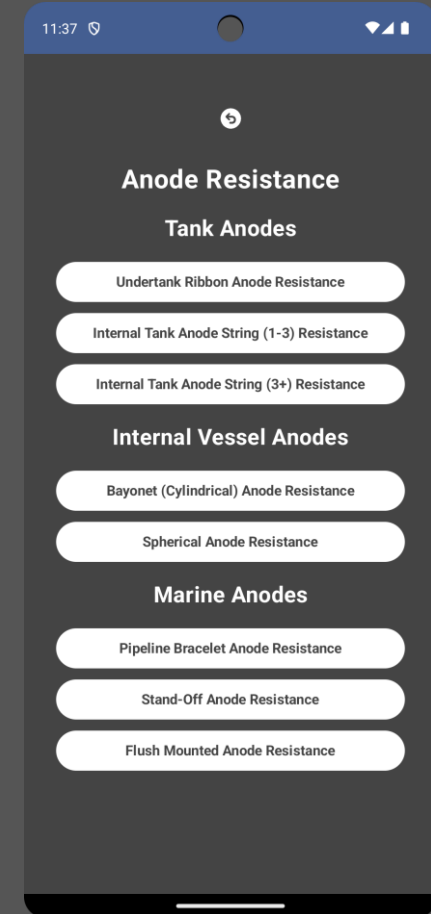


Marine Anodes Resistance

Pipeline Bracelet Anode Resistance

Stand-Off Anode Resistance

Flush Mounted Anode Resistance



Pipeline Bracelet Anode Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Length, L

Anode Inner Diameter, D

Anode Thickness, t

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Centimeters, Inches

Outputs

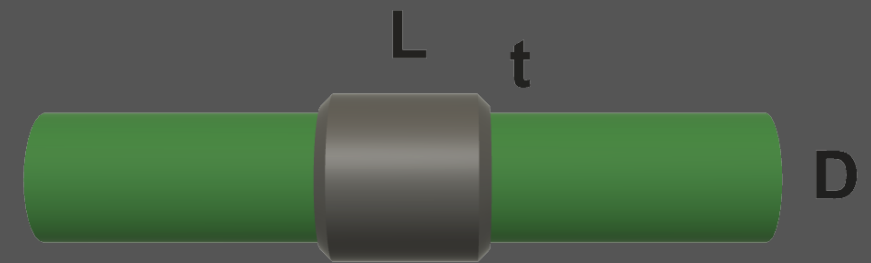
Resistance ¹

Liquid Resistivity ²

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Stand-Off Anode Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Options: Cylindrical ³ , Rectangular ⁴ , Trapezoidal ⁵

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Length, L

Anode Diameter, D ³

Anode Width, W ⁴

Anode Width (Small), W1 ⁵

Anode Width (Large), W2 ⁵

Anode Height, H

Outputs

Resistance ¹

Liquid Resistivity ²

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Meters, Feet

Centimeters, Inches

Centimeters, Inches

Centimeters, Inches

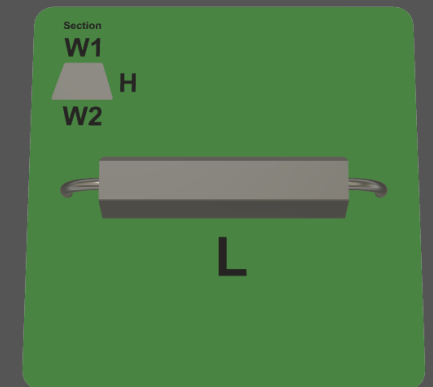
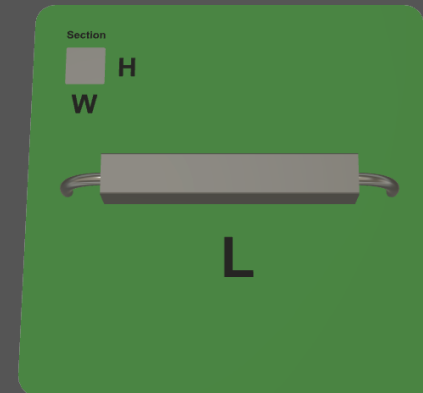
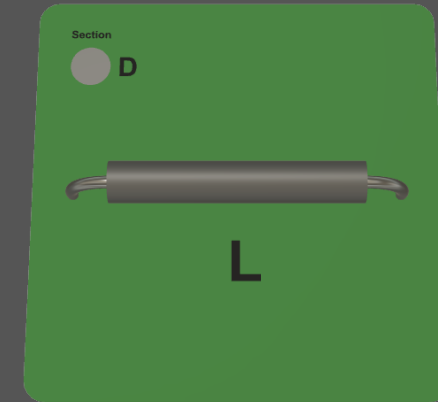
Centimeters, Inches

Centimeters, Inches

Units

Ohms, Milliohms

Ohm/Centimeter, Ohm/Foot



Flush Mounted Anode Resistance

Options: Resistance ¹ , Liquid Resistivity ²

Options: Circular ³ , Rectangular ⁴

Inputs

Liquid Resistivity ¹

Resistance ²

Anode Diameter, D ³

Anode Length, L ⁴

Anode Width, W ⁴

Anode Thickness, t

Units

Ohm/Centimeter, Ohm/Foot

Ohms, Milliohms

Centimeters, Inches

Meters, Feet

Centimeters, Inches

Centimeters, Inches

Outputs

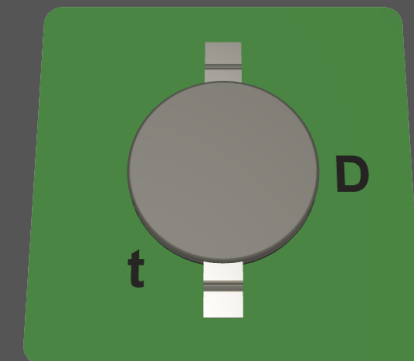
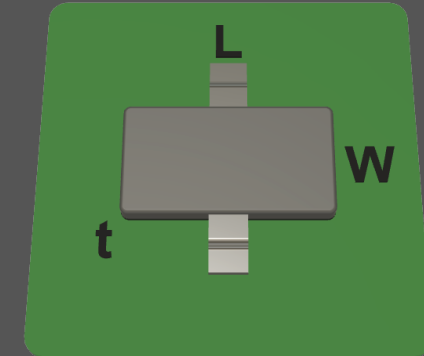
Resistance ¹

Liquid Resistivity ²

Units

Ohms, Milliohms

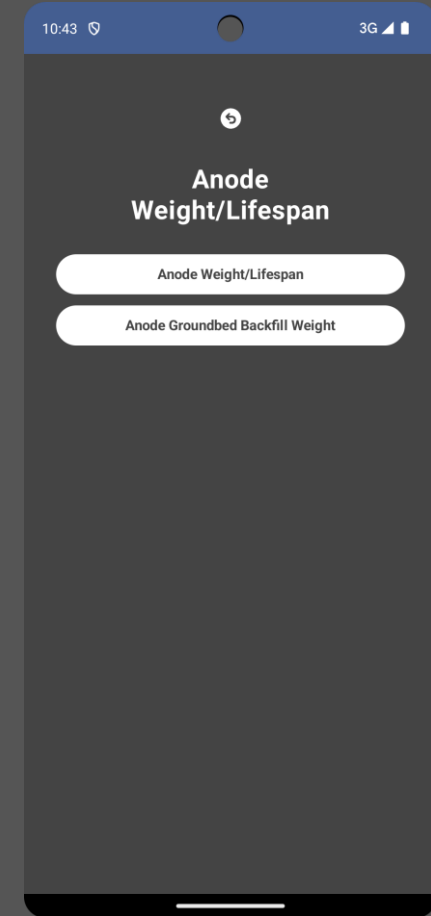
Ohm/Centimeter, Ohm/Foot



Anode Weight/Lifespan

Anode Weight/Lifespan

Anode Groundbed Backfill Weight



Anode Weight/Lifespan

Options: Weight ¹ , Lifespan ²

Inputs

Lifespan ¹

Anode Weight ²

Cathodic Protection Current

Theoretical Consumption Rate

Efficiency

Utilization Factor

Outputs

Anode Weight ¹

Lifespan ²

Units

Years

Kilograms, Pounds

Amps, Milliamps

Kilograms/Amp-Year, Pounds/Amp-Year

Percent (%)

Number

Units

Kilograms, Pounds

Years



Anode Groundbed Backfill Weight

Options: Horizontal Anode ¹ , Vertical Anode ²

Inputs

Backfill Material Bulk Density

Anode Trench Length ¹

Anode Trench Width ¹

Number of Trenches ¹

Number of Anodes per Trench ¹

Anode Hole Length ²

Anode Hole Diameter ²

Number of Holes ²

Number of Anodes per Hole ²

Anode Ingot Length

Anode Ingot Diameter

Units

Grams/Centimeter³, Pounds/Feet³

Meters, Feet

Meters, Feet

Number

Number

Meters, Feet

Centimeters, Inches

Number

Number

Meters, Feet

Centimeters, Inches

Outputs

Backfill Weight

Units

Kilograms, Pounds

Backfill Type	Bulk Density (lb/ft ³)
Coke Breeze	
Loresco SW	54
Loresco SWK	70
Loresco SWS	68
Loresco DW1	74
Loresco SC2	74
Loresco SC3	74
Loresco RS3	68
Loresco EnviroCoke IV	65
Loresco FlexFill	68
Loresco PermaPlug	70
Loresco PowerFill	74
Loresco PowerSet	65
Bentonite	72

Anode Current Density

Options: Anode Material

Options: Cylindrical/Circular ¹ , Rectangular ² , Trapezoidal ³ , Spherical ⁴

Inputs

Cathodic Protection Current

Anode Length, L ^{1, 2, 3}

Anode Diameter, D ^{1, 4}

Anode Width, W ²

Anode Width (Small), W1 ³

Anode Width (Large), W2 ³

Anode Height, H ^{2, 3}

Units

Amps, Milliamps

Meters, Feet

Centimeters, Inches

Centimeters, Inches

Centimeters, Inches

Centimeters, Inches

Centimeters, Inches

Outputs

Current Density

Units

Amps/Meter² , Amps/Foot²

Anode / Backfill Material	Environment	Consumption Rate (pounds/amp-year)	Efficiency	Maximum Allowable Current Density (amps/meter ²)
Steel	Soil / Fresh Water	7.63		5.00
High Silicon Cast Iron	Soil / Fresh Water	2.20	85%	10.80
Graphite	Soil / Fresh Water	2.20	85%	10.00
Platinized Titanium & Niobium	Soil / Fresh Water	$2.60 * 10^{-5}$	85%	
Mixed Metal Oxide (MMO)	Soil / Fresh Water	$< 2.20 * 10^{-6}$		
Coke Breeze	Soil / Fresh Water			1.60

Anode Current Density

Options: Backfill Material

Options: Cylindrical ¹ , Rectangular ²

Inputs

Cathodic Protection Current

Backfill Length, L

Backfill Diameter, D ¹

Anode Width, W ²

Anode Height, H ²

Units

Amps, Milliamps

Meters, Feet

Centimeters, Inches

Centimeters, Inches

Centimeters, Inches

Outputs

Current Density

Units

Amps/Meter² , Amps/Foot²

Anode / Backfill Material	Environment	Consumption Rate (pounds/amp-year)	Efficiency	Maximum Allowable Current Density (amps/meter ²)
Steel	Soil / Fresh Water	7.63		5.00
High Silicon Cast Iron	Soil / Fresh Water	2.20	85%	10.80
Graphite	Soil / Fresh Water	2.20	85%	10.00
Platinized Titanium & Niobium	Soil / Fresh Water	$2.60 * 10^{-5}$	85%	
Mixed Metal Oxide (MMO)	Soil / Fresh Water	$< 2.20 * 10^{-6}$		
Coke Breeze	Soil / Fresh Water			1.60

Galvanic Anode Current Output

Options: HP Magnesium, SP Magnesium, Zinc, Aluminum

Inputs

Resistance

Native Potential

Units

Ohms, Milliohms

Volts, Millivolts

Outputs

Current Output

(To Start Polarization from Native Potential)

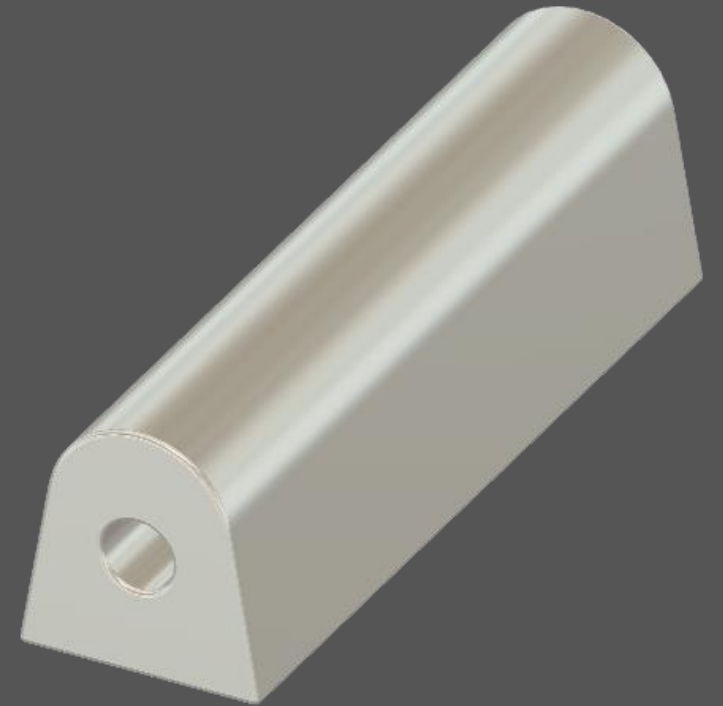
Current Output

(To Maintain -850 mV Polarized Potential)

Units

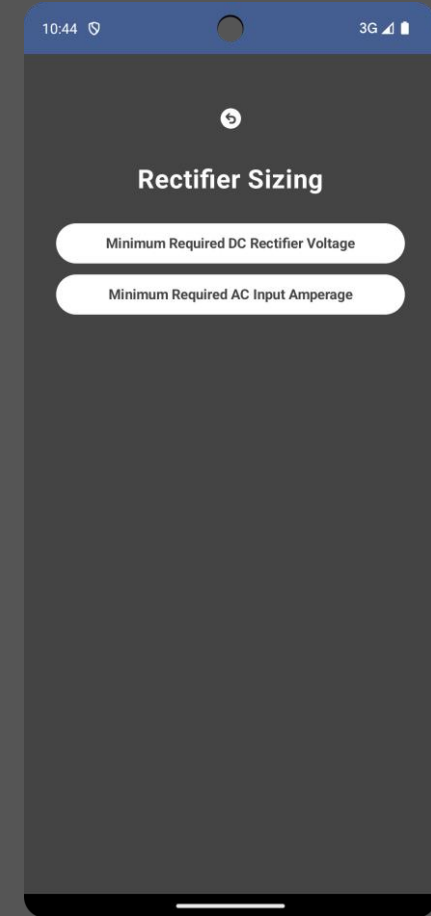
Amps, Milliamps

Amps, Milliamps



Rectifier Sizing

Minimum Required DC Rectifier Voltage
Minimum Required AC Input Amperage



Minimum Required DC Rectifier Voltage

Inputs

Cathodic Protection Current

Total Resistance

 Anode Resistance

 Structure Resistance

 Structure Header Resistance

 Anode Header Resistance

Safety Factor

Outputs

DC Rectifier Voltage
(Without 2 Volt Back Voltage)

DC Rectifier Voltage
(With 2 Volt Back Voltage)

Units

Amps, Milliamps

Ohms, Milliohms

Ohms, Milliohms

Ohms, Milliohms

Ohms, Milliohms

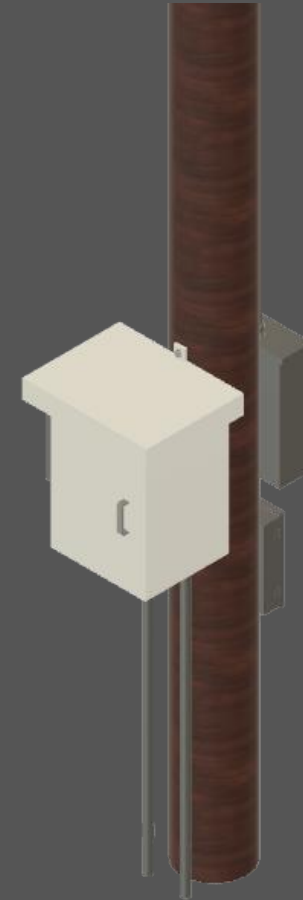
Ohms, Milliohms

Number

Units

Volts, Millivolts

Volts, Millivolts



Minimum Required AC Input Amperage

Inputs

AC Input Voltage

DC Output Voltage

DC Output Amperage

Power Factor

Conversion Efficiency

Units

Volts, Millivolts

Volts, Millivolts

Amps, Milliamps

Number

Percent (%)

Outputs

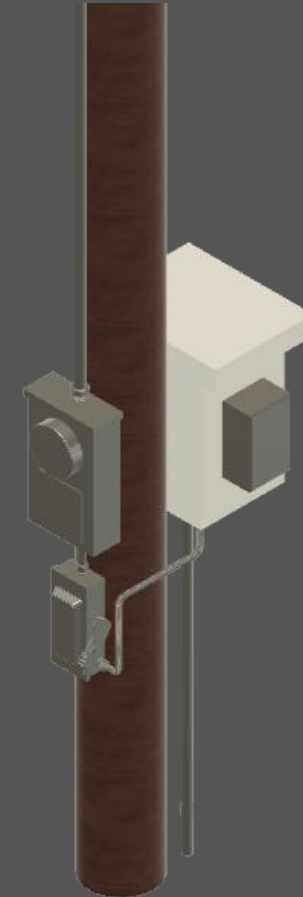
AC Input Amperage
(Single Phase)

AC Input Amperage
(Three Phase)

Units

Amps, Milliamps

Amps, Milliamps



Interference Analysis

General

Coating Holiday / Coupon Current Density

DC Interference Analysis

Voltage Rise Analysis

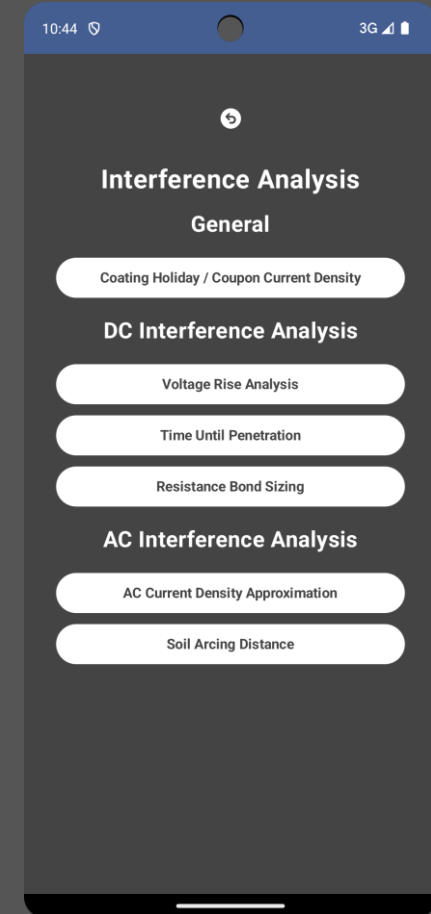
Time Until Penetration

Resistance Bond Sizing

AC Interference Analysis

AC Current Density Approximation

Soil Arcing Distance



Coating Holiday / Coupon Current Density

Options: Current ¹ , Voltage/Resistance ²

Inputs

Current ¹

Voltage ²

Resistance ²

Holiday Surface Area

Units

Amps, Milliamps

Volts, Milliamps

Ohms, Milliohms

Centimeter² , Inch²

Outputs

Current Density
(Per Square Meter)

Current Density
(Per Square Centimeter)

Current Density
(Per Square Foot)

Units

Amps/Meter² , Milliamps/Meter²

Amps/Centimeter² , Milliamps/Centimeter²

Amps/Foot² , Milliamps/Foot²



Voltage Rise Analysis

Options: Horizontal Anode, Vertical Anode

Inputs

Distance From Anode

Soil Resistivity

Anode Length

Anode Resistance

Cathodic Protection Current

Outputs

Voltage Rise at Distance

Voltage Rise Percent

Units

Meters, Feet

Ohm-Centimeter, Ohm-Foot

Meters, Feet

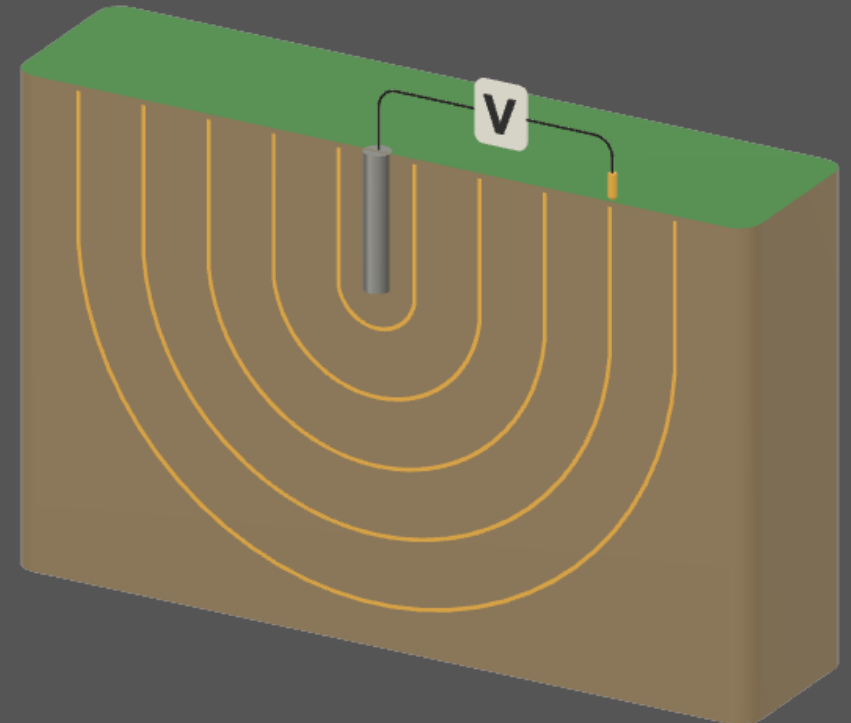
Ohms, Milliohms

Amps, Milliamps

Units

Volts, Millivolts

Percent (%)



Time Until Penetration

Options: Carbon Steel

Inputs

Current Density

Soil Resistivity at Pipe Depth

Units

Amps/Meter² , Amps/Foot²

Millimeters, Inches

Outputs

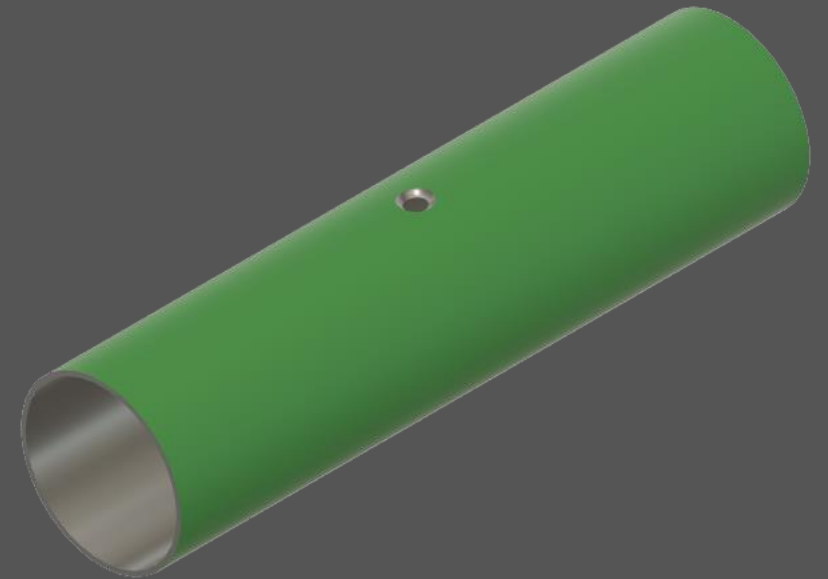
Corrosion Rate

Time Until Penetration

Units

Millimeters/Year, Mils/Year

Years



Resistance Bond Sizing

Inputs

Rectifier Current, C

Initial Potential of Line 1 at Crossing with Rectifier On and Temporary Bond Open-Circuited, V1(on, ioc)

Initial Potential of Line 1 at Crossing with Rectifier Off and Temporary Bond Open-Circuited, V1(off, ioc)

Initial Potential of Line 2 at Crossing with Rectifier On and Temporary Bond Open-Circuited, V2(on, ioc)

Initial Potential of Line 2 at Crossing with Rectifier Off and Temporary Bond Open-Circuited, V2(off, ioc)

Temporary Bond Current, I(b,t)

Initial Potential of Line 1 at Crossing with Rectifier On and Temporary Bond Close-Circuited, V1(on, icc)

Initial Potential of Line 2 at Crossing with Rectifier On and Temporary Bond Close-Circuited, V2(on, icc)

Units

Amps, Milliamps

Volts, Millivolts

Volts, Millivolts

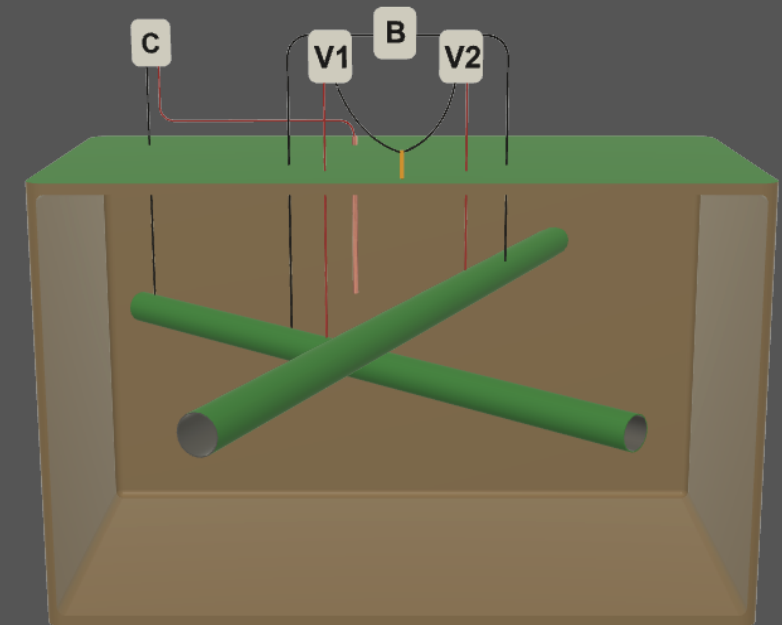
Volts, Millivolts

Volts, Millivolts

Amps, Milliamps

Volts, Millivolts

Volts, Millivolts



Resistance Bond Sizing

Outputs

Required Permanent Bond Size, B

Permanent Bond Current On, $I(b,p \text{ on})$

Permanent Bond Current Off, $I(b,p \text{ off})$

Final Potential of Line 1 at Crossing with Rectifier On and Permanent Bond Close-Circuited, $V1(\text{on f,cc})$

Final Potential of Line 1 at Crossing with Rectifier Off and Permanent Bond Close-Circuited, $V1(\text{off f,cc})$

Final Potential of Line 2 at Crossing with Rectifier On and Permanent Bond Close-Circuited, $V2(\text{on f,cc})$

Final Potential of Line 2 at Crossing with Rectifier Off and Permanent Bond Close-Circuited, $V2(\text{off f,cc})$

Units

Ohms, Milliohms

Amps, Milliamps

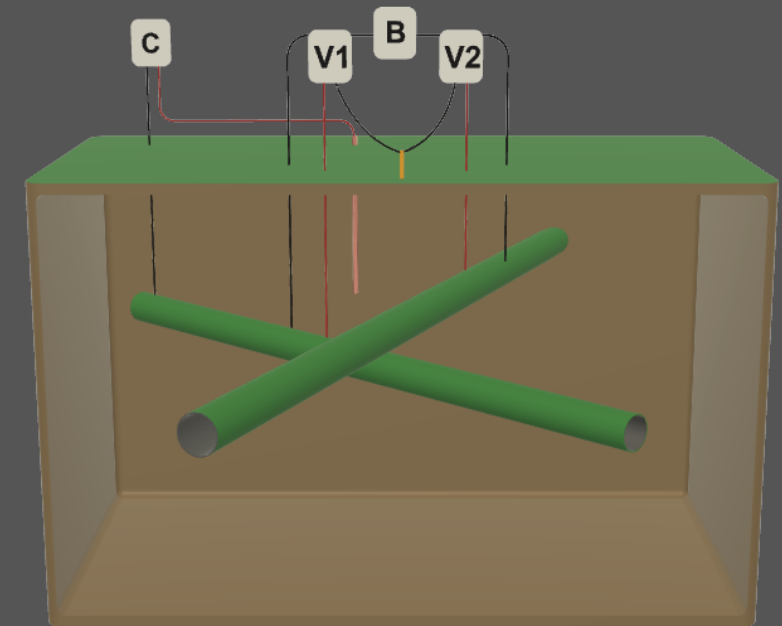
Amps, Milliamps

Volts, Millivolts

Volts, Millivolts

Volts, Millivolts

Volts, Millivolts



AC Current Density Approximation

Options: Current Density, Soil Resistivity, AC Voltage

Inputs

Current Density

Soil Resistivity

AC Voltage

Holiday Surface Area

Units

Amps/Meter² , Amps/Foot²

Ohm-Centimeter, Ohm-Foot

Volts, Millivolts

Centimeter² , Inch²

Outputs

Current Density

Soil Resistivity

AC Voltage

Units

Amps/Meter² , Amps/Foot²

Ohm-Centimeter, Ohm-Foot

Volts, Millivolts

* Pick two Inputs (*excluding Holiday Surface Area*)
to solve for the third input as the Output



AC Current Density (amps/meter ²)	Condition
$i_{AC} < 30$	No AC Corrosion
$30 < i_{AC} < 100$	AC Corrosion Unpredictable
$i_{AC} > 100$	AC Corrosion Expected

Soil Arcing Distance

Options*: Arcing Distance, Soil Resistivity, Fault Current

Inputs

Arcing Distance

Soil Resistivity

Fault Current

Units

Meters, Feet

Ohm-Centimeter, Ohm-Foot

Kiloamps, Amps

Outputs

Units

@ Soil Resistivity $\leq 10,000$ Ohm-Centimeter

Arcing Distance

Meters, Feet

Soil Resistivity

Ohm-Centimeter, Ohm-Foot

Fault Current

Kiloamps, Amps

@ Soil Resistivity $\geq 100,000$ Ohm-Centimeter

Arcing Distance

Meters, Feet

Soil Resistivity

Ohm-Centimeter, Ohm-Foot

Fault Current

Kiloamps, Amps



* Pick two Inputs to solve for the third input as the Output

DC Attenuation Calculations

Options: Sending End Current ¹ , Receiving End Current ²

Inputs

Sending End Current ¹

Receiving End Current ²

Unit Linear Resistance

Unit Conductance to Earth

Maximum Number of Unit Lengths from Sending End

Number of Unit Lengths from Sending End

Units

Amps, Milliamps

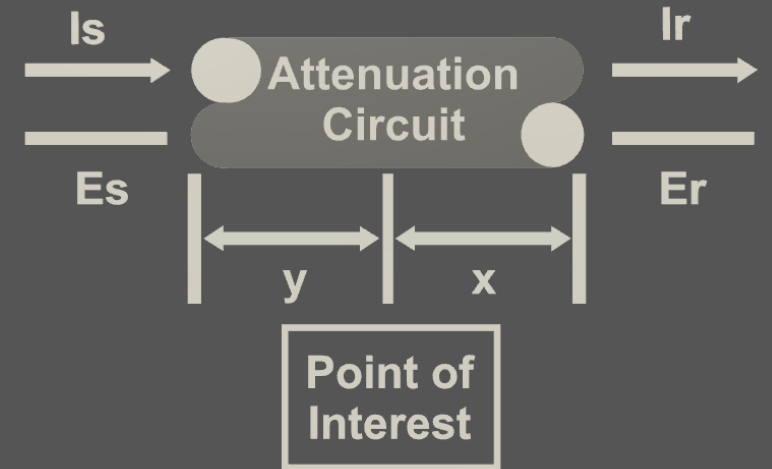
Amps, Milliamps

Ohms/Unit Length,
Milliohms/Unit Length

Siemens/Unit Length,
Millisiemens/Unit Length

Number

Number



DC Attenuation Calculations

Options: Sending End Current ¹ , Receiving End Current ²

Outputs

Number of Units from Receiving End

Attenuation Constant

Characteristic Resistance

Resistance Looking into Open Line

Sending End Potential ¹

Potential Knowing Sending End Potential ¹

Potential Knowing Sending End Potential /
Sending End Potential ¹

Current Knowing Sending End Current ¹

Receiving End Potential ²

Potential Knowing Receiving End Potential ²

Current Knowing Receiving End Current ²

Units

Number

Number

Ohms, Milliohms

Ohms, Milliohms

Volts, Millivolts

Volts, Millivolts

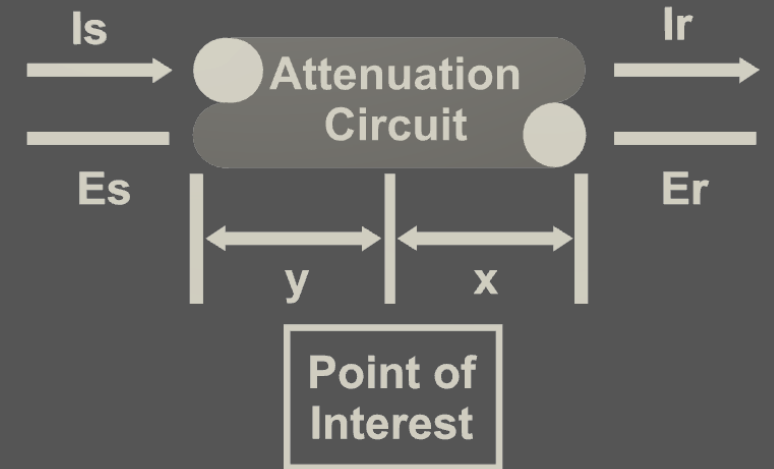
Percent (%)

Amps, Milliamps

Volts, Millivolts

Volts, Millivolts

Amps, Milliamps

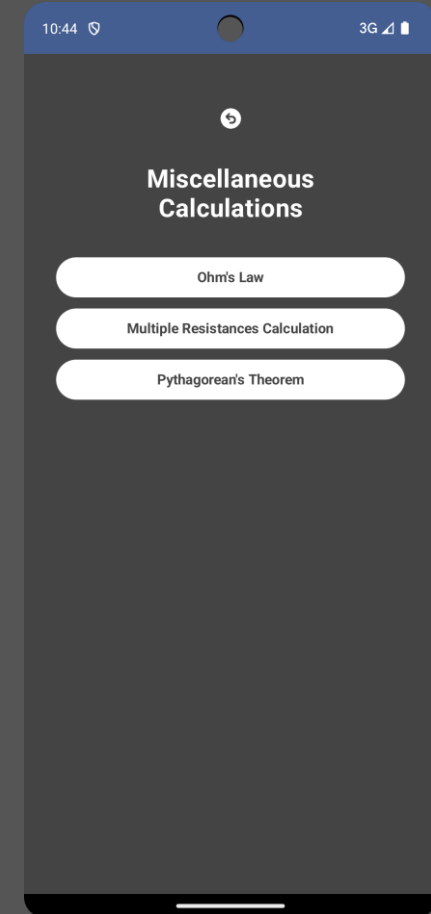


Miscellaneous Calculations

Ohm's Law

Multiple Resistances Calculation

Pythagorean's Theorem



Ohm's Law

Options*: Voltage, Current, Resistance

Inputs

Voltage, V

Current, I

Resistance, R

Outputs

Voltage, V

Current, I

Resistance, R

Units

Volts, Millivolts

Amps, Milliamps

Ohms, Milliohms

Units

Volts, Millivolts

Amps, Milliamps

Ohms, Milliohms

$$V = I * R$$

$$I = V / R$$

$$R = V / I$$

* Pick two Inputs to solve for the third input as the Output

Multiple Resistances Calculation

Inputs

Resistance 1

Resistance 2

Resistance 3

Resistance 4

Resistance 5

Units

Ohms, Milliohms

Ohms, Milliohms

Ohms, Milliohms

Ohms, Milliohms

Ohms, Milliohms

Outputs

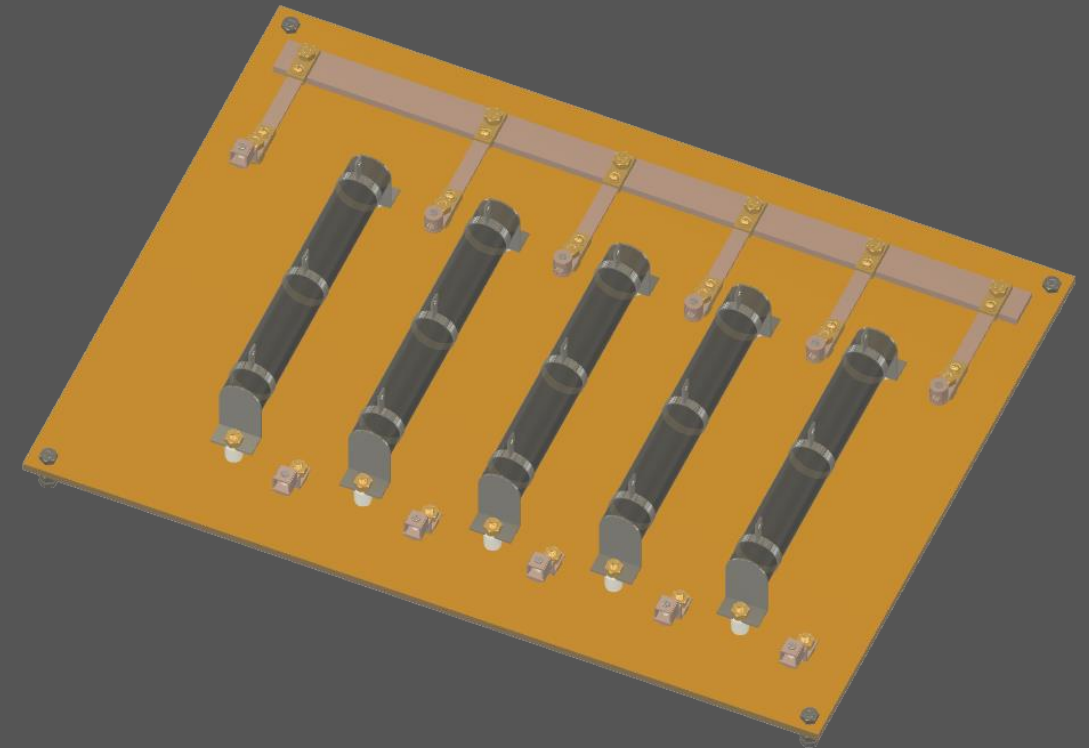
Series Resistance

Parallel Resistance

Units

Ohms, Milliohms

Ohms, Milliohms



Pythagorean's Theorem

Inputs

Length, A

Height, B

Outputs

Hypotenuse, C

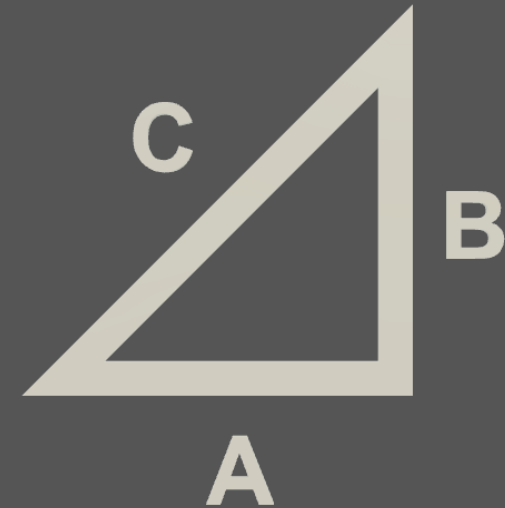
Units

Number

Number

Units

Number



Extras

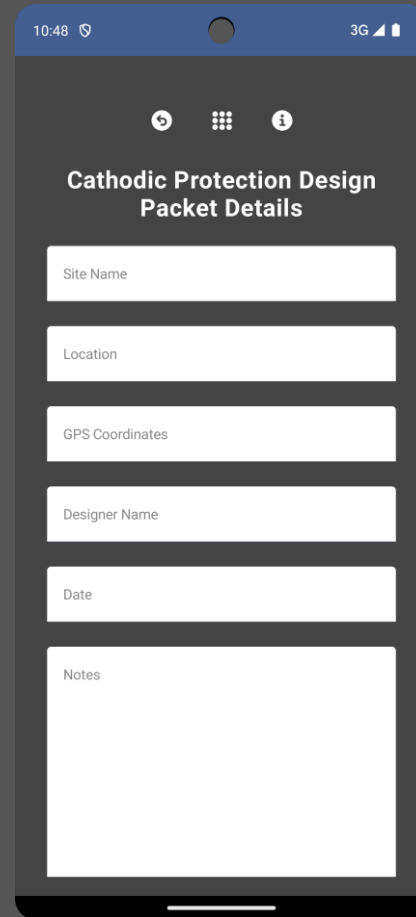
Report Templates

Cathodic Protection Design Packet Details

Combine Calculation Screenshots



Cathodic Protection Design Packet Details



A mobile application interface for entering Cathodic Protection Design Packet Details. The screen features a dark blue header with the time 10:48, signal strength 3G, and battery level. Below the header are three navigation icons: a back arrow, a grid of dots, and an information icon. The main title is "Cathodic Protection Design Packet Details". The form consists of several white input fields stacked vertically: "Site Name", "Location", "GPS Coordinates", "Designer Name", "Date", and a larger "Notes" field at the bottom.

Combine Calculation Screenshots

Cathodic Protection Design Packet Details

CR 1863

Bulverde, Texas

32.00000, -139.00000

Ryan Ell

10-25-2024

Deep well anode groundbed with 6 MMO anodes

Pipeline Current Requirement

Current Requirement: 2.0 millamps/foot²

Pipeline Length, L: 30000 feet

Pipeline Diameter, D: 12.0 inches

Percent Coating Efficiency: 95.0%

calculate clear

Cathodic Protection Current: 9.424 amps

Deep Anode Groundbed Resistance

Resistance Soil Resistivity

Soil Resistivity: 5000 ohm-cm

Anode Backfill Length, L: 150 feet

Anode Backfill Diameter, D: 8 inches

calculate clear

Resistance: 1.010 ohms

Anode Current Density

Anode Material: Backfill Material

Cylindrical Rectangular

Cathodic Protection Current: 9.424 amps

Backfill Length: 150 feet

Backfill Diameter: 8 inches

calculate clear

Current Density: 0.322 amps/meter²

Minimum Required DC Rectifier Voltage

Cathodic Protection Current: 9.424 amps

Total Resistance

Anode Resistance: 1.01 ohms

Structure Resistance: 0.0 ohms

Structure Header Cable Resistance: 0.01 ohms

Anode Header Cable Resistance: 0.01 ohms

Safety Factor: 1.15

calculate clear

DC Rectifier Voltage

Without 2 Volt Back Voltage: 11.163 volts

With 2 Volt Back Voltage: 13.163 volts

Minimum Required DC Rectifier Voltage

Anode Resistance: 1.01 ohms

Structure Resistance: 0.0 ohms

Structure Header Cable Resistance: 0.01 ohms

Anode Header Cable Resistance: 0.01 ohms

Safety Factor: 1.15

calculate clear

DC Rectifier Voltage

Without 2 Volt Back Voltage: 11.163 volts

With 2 Volt Back Voltage: 13.163 volts

Cathodic Protection Design Packet Details

CR 1863

Bulverde, Texas

32.00000, -139.00000

Ryan Ell

10-25-2024

Deep well anode groundbed with 6 MMO anodes

Pipeline Current Requirement

Current Requirement: 2.0 millamps/foot²

Pipeline Length, L: 30000 feet

Pipeline Diameter, D: 12.0 inches

Percent Coating Efficiency: 95.0%

calculate clear

Cathodic Protection Current: 9.424 amps

Deep Anode Groundbed Resistance

Resistance Soil Resistivity

Soil Resistivity: 5000 ohm-cm

Anode Backfill Length, L: 150 feet

Anode Backfill Diameter, D: 8 inches

calculate clear

Resistance: 1.010 ohms

Anode Current Density

Anode Material: Backfill Material

Cylindrical Rectangular

Cathodic Protection Current: 9.424 amps

Backfill Length: 150 feet

Backfill Diameter: 8 inches

calculate clear

Current Density: 0.322 amps/meter²

Minimum Required DC Rectifier Voltage

Cathodic Protection Current: 9.424 amps

Total Resistance

Anode Resistance: 1.01 ohms

Structure Resistance: 0.0 ohms

Structure Header Cable Resistance: 0.01 ohms

Anode Header Cable Resistance: 0.01 ohms

Safety Factor: 1.15

calculate clear

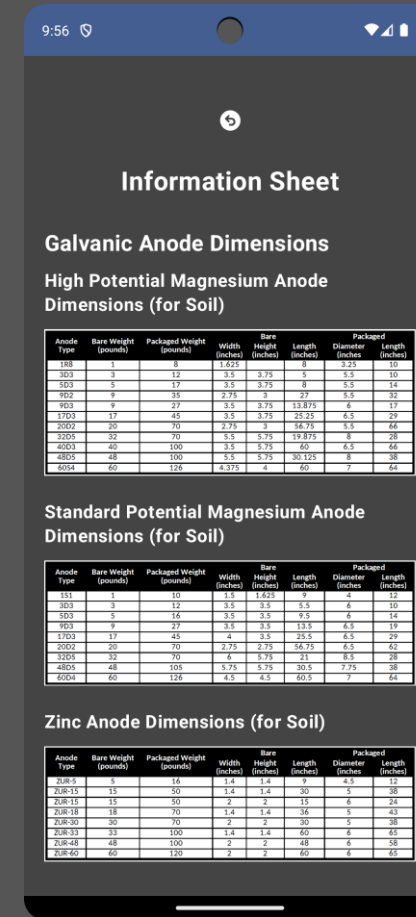
DC Rectifier Voltage

Without 2 Volt Back Voltage: 11.163 volts

With 2 Volt Back Voltage: 13.163 volts

*Feature Only Available on iPhone App

Basic Calculator & Information Sheet



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