Virtual Brew:
Mornings with AI

Calculating AC Current Density

Michael Plaster

Holiday

Agenda

- Why does AC matter?
- AC Coupon Sizes
- AC current density with Bullhorn / RM4210/4250
- Manually calculating AC current density (with a Triton & Coupon)

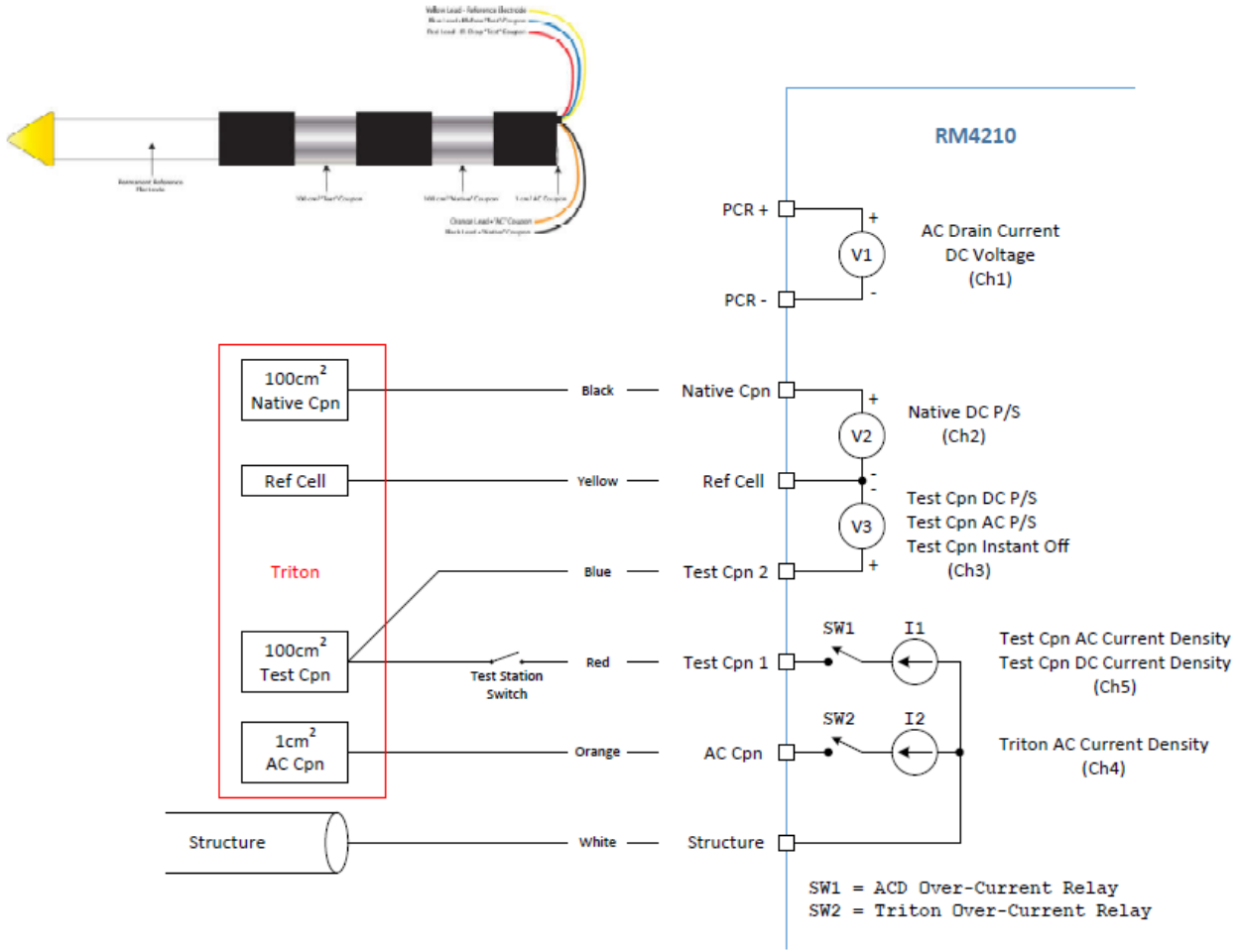
Why Should I Care About AC?

- **AC Corrosion**:
  - Prolonged AC interference can lead to rapidly-accelerated corrosion on your pipeline
- **Coating & Pipeline Damage**
  - Exposure to unmitigated AC stray currents can cause damage to coatings & metal loss
- **Safety Hazards**:
  - High induced AC voltage present a shock hazard to pipeline personnel
- **Regulation**
  - PHMSA 192.473 (Mega Rule) has been modified and references AC interference

PHMSA Regulations

- *Each operator whose pipeline system is subjected to stray currents shall have in effect a continuing program to minimize the detrimental effects of such currents. (PHMSA 192.473a)*
- *Development of a remedial action plan to correct any instances where interference current is greater than or equal to 100 amps per meter squared (AC) or if it impedes the safe operation of a pipeline, or if it may cause a condition that would adversely impact the environment or the public; (PHMSA 192.473c3)*

Remote Monitor



Manual Calculation of AC Current Density –

The most common question to support on our AC monitors

~~How do I install my remote monitor?~~

How do I take a manual read for AC Current Density?

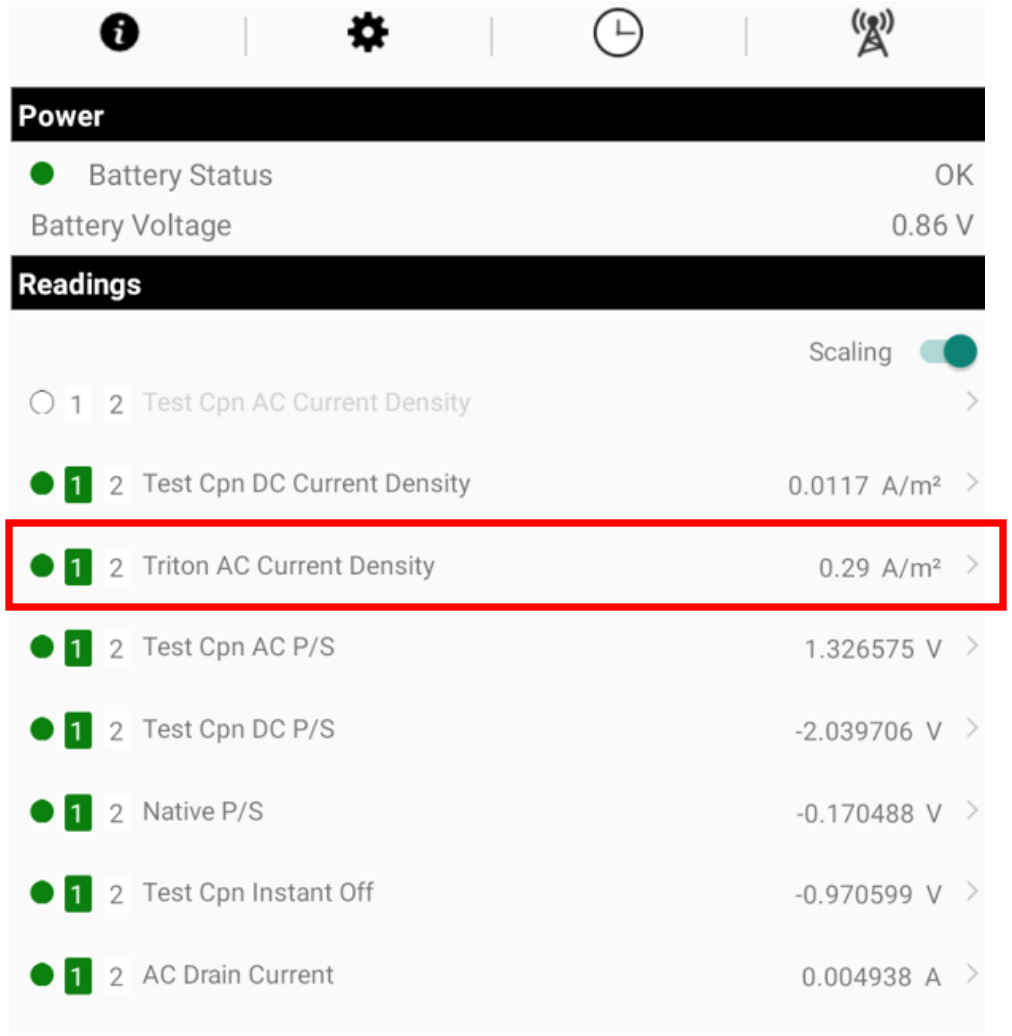
AC Coupons: Tiny but Mighty!

AC Coupon Sizes

- $1cm^2$
- $10cm^2$
- $1.4in^2$
- Which size do we use?

AC Testing

AC Testing


Power
Battery Status
OK
Battery Voltage
0.86 V
Readings
Scaling
1 2 Test Cpn AC Current Density
1 2 Test Cpn DC Current Density
0.0117 A/m²
1 2 Triton AC Current Density
0.29 A/m²
1 2 Test Cpn AC P/S
1.326575 V
1 2 Test Cpn DC P/S
-2.039706 V
1 2 Native P/S
-0.170488 V
1 2 Test Cpn Instant Off
-0.970599 V
1 2 AC Drain Current
0.004938 A

Scenario

Taking a manual AC reading on a Triton Coupon Test Station

- Disconnect the RMU
- Plug DVM into AC Coupon & Structure
- Flip the Switch to **open**
  - Avoids interference from DC Test Coupon
- Know your coupon size

Manual Calculation of AC Current Density – 1cm²

Manual Read: 27 mA

Coupon Size: 1cm²

Formula: $\left(\frac{Current}{Coupon\ Size}\right) * \left(\frac{1A}{1A}\right) * \left(\frac{100cm2}{1m2}\right)$ = Reading $\frac{A}{m^2}$

Knock-Knock

1. $\left(\frac{27mA}{1cm2}\right) * \left(\frac{1A}{1000mA}\right) * \left(\frac{100cm}{1m}\right) * \left(\frac{100cm}{1m}\right)$= (X) $\frac{A}{m^2}$

2. $\left(\frac{27}{1}\right) * \left(\frac{1}{1000}\right) * \left(\frac{100}{1}\right) * \left(\frac{100}{1}\right)$= (X) $\frac{A}{m^2}$

3. $\left(27(\frac{10000}{1000})\right)$= (X) $\frac{A}{m^2}$

4. 27*10 = **270** $\frac{A}{m^2}$

Manual Calculation of AC Current Density – 10cm²

Manual Read: 27 mA

Coupon Size: 10cm²

Formula: $\left(\frac{Current}{Coupon\ Size}\right) * \left(\frac{1A}{1A}\right) * \left(\frac{100cm2}{1m2}\right)$ = Reading $\frac{A}{m^2}$

1. $\left(\frac{.027A}{10cm2}\right) * \left(\frac{1A}{1A}\right) * \left(\frac{100cm}{1m}\right) * \left(\frac{100cm}{1m}\right)$= (X) $\frac{A}{m^2}$

2. $\left(\frac{.027}{10}\right) * \left(\frac{1}{1}\right) * \left(\frac{100}{1}\right) * \left(\frac{100}{1}\right)$= (X) $\frac{A}{m^2}$

3. $\left(.0027(\frac{10000}{1})\right)$= (X) $\frac{A}{m^2}$

4. .0027*10000 = **27** $\frac{A}{m^2}$

Manual Calculation of AC Current Density – 1.4in²

Manual Read: 27 mA

Coupon Size: 1.4in²

Formula: $\left(\frac{Current}{Coupon\ Size}\right) * \left(\frac{1A}{1000mA}\right) * \left(\frac{100cm2}{1m2}\right)$= AC Current density $\frac{A}{m^2}$

1. Convert your coupon from inches to cm : 1.4in² = 9.032cm²

$(2.989 * 10)$= **29.89A/m²**

2. $\left(\frac{27mA}{9.032cm2}\right) * \left(\frac{1A}{1000mA}\right) * \left(\frac{100cm}{1m}\right) * \left(\frac{100cm}{1m}\right)$ = (X) $\frac{A}{m^2}$

3. $\left(\frac{27}{9.032}\right) * \left(\frac{1A}{1000}\right) * \left(\frac{100}{1m}\right) * \left(\frac{100}{1m}\right)$ = (X) $\frac{A}{m^2}$

4. $(2.989) * \left(\frac{10000}{1000}\right)$ = (X) $\frac{A}{m^2}$

Manual Calculation of AC Current Density – Simplify

Manual Read: 27 mA

Coupon Size: 1cm² $27 * 10$ $= \mathbf{270} \frac{A}{m^2}$

Coupon Size: 10cm² 27 $= \mathbf{27} \frac{A}{m^2}$

Coupon Size: 1.4in² $\left(\frac{27}{9.032}\right) * 10$ $= \mathbf{29.89} \frac{A}{m^2}$

Conclusion

1) Start by checking the read on the RMU with Bullhorn Tools
2) Directly taking the reading off the Triton Coupon helps eliminate IR errors.
3) Flipping the switch to the open position helps eliminate DC interference.
4) Knowing your coupon size is very important.