

Locating Methods for use in 4 Conductor MDT

- Locating using bridge measurement
- Pin-pointing using electromagnetic fields
- Locating and characterizing using TDR
- Advanced Structural Analysis

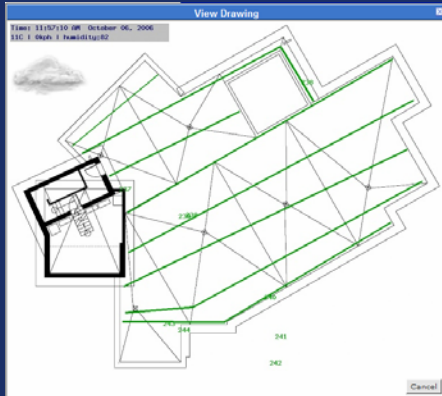


MDT Placement



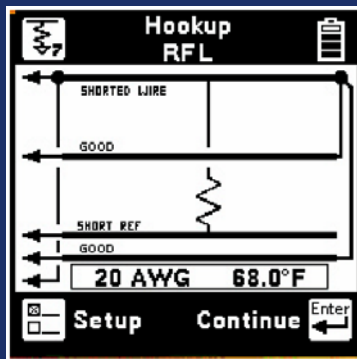
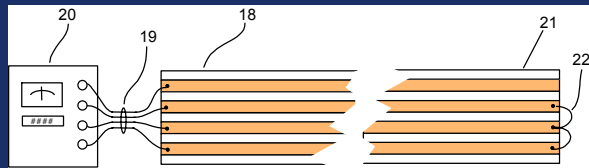
4 Conductor MDT is placed on deck.

Automated Monitoring



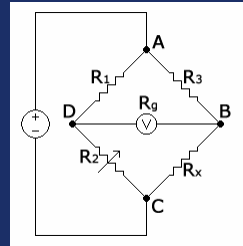
Zones are monitored for signs of moisture intrusion

Locating using 4C MDT



- 4C MDT consists of two pairs similar to the regular MDT and 2 insulated pairs used as a return or 'strap back'.
- These are strapped back at the far end of MDT
- Resistance Fault Locator is connected as shown
- Faults less than 5 Megohms can be detected and distance to fault can be located

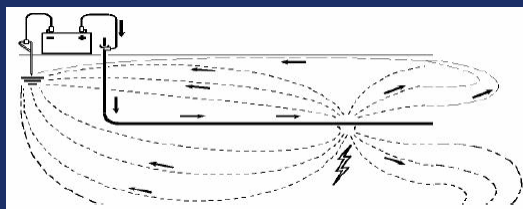
Locating using 4C MDT



- Wheatstone bridge is used to solve for R_x by adjusting R_2
- First measure MDT through strap back to get distance.
- Then measure through MDT through fault and back through strap back. Difference will give you the fault.
- Then measure between the two MDT pairs and subtract fault to solve all unknowns.

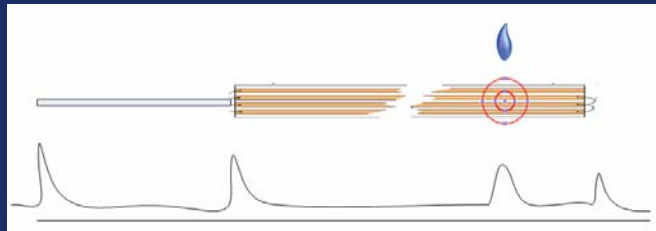
Electric Field Vector Mapping (EFVM)

- 3M A-Frame can be used to verify and pinpoint wet sections on the MDT.
- This is done by injecting an AC current on the MDT and then trace the resulting AC electromagnetic (EM) field with a tuned receiver.
- Current will flow out of the wet area on the MDT to the roof and back to the transmitter ground.
- The A frame turns the locator into a sensitive voltmeter which gives the direction to and magnitude of the fault.



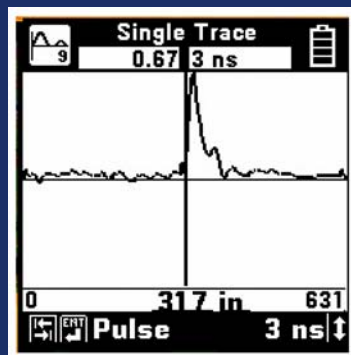
Locating using TDR

- TDR transmits a pulse of energy that propagates along the MDT.
- A portion of the energy is reflected back to the sending end whenever it passes a change in the impedance.
- Knowing the speed of the pulse and the time to get the reflection will give the distance to the anomaly.
- The impedance includes the sum of all the reactive resistance in the MDT.
 1. The DC resistance of the MDT copper conductors.
 2. The resistance between the MDT copper conductors and/or between moisture probes.
 3. The capacitance created between the MDT copper conductor and structure.
 4. And the inductance of the MDT itself.



Locating using TDR

- Distance of cable to tape can be identified
- Length of tape can be identified
- TDR gives a predictable trace depending on the type of material the MDT is adhered to.
- Trace changes as the material takes on moisture.



4C Tape for Advanced Structural Analysis

- 4C tape for concrete/stone wall & mortar monitoring using resistance/dielectric methods and TDR locating
- 4C tape can be adhered to various surfaces and embedded in different materials.
- Once in place, a baseline of resistance, capacitance and inductance can be recorded along with a baseline TDR trace.
- As the material in which the 4C tape is installed in changes with respect to moisture, chemical content, positioning etc. we can obtain a delta from the baseline.
- Using these methods, characterization of these materials is possible.

