



THE EASTERN SPECIALTY COMPANY

SIMULATING REAL WORLD METERING CONDITIONS

Prepared by Dan Hollow

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TESCO – The Eastern Specialty Company

for Rocky Mountain Meter School

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4:00PM-5:00PM





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INTRODUCTION / BIOGRAPHY

Dan has worked for TESCO since 2015, and was originally hired to sell the Meter Manager Meter Asset Management Software and then was given the Rocky Mountain Region Sales Territory in late 2016 and now sells the TESCO products in 4 states (CO, WY, UT, MT, ID, AZ, and the western half of KS, NE, SD, and ND). Dan has been working in the utility industry since 1988 and began his career in the utility industry as the Test Department Supervisor for Aptech. In 1992 he accepted an outside sales position with Aptech and has been in outside sales ever since. Dan has worked for companies such as UTS/Itron, Datamatic, SmartSynch, Metrum Technologies/Aclara, and TESCO. Primary background is in Electronics.

Dan has worked in the technology industry since 1980 and has worked in other industries such as Banking Equipment, Industrial CNC Controls, Process Controls and Flight Simulation Equipment prior to working in the utility industry.



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COURSE OUTLINE

To subject Electric Meters to non-nominal conditions more similar to what meters would experience in the field as opposed to the nominal operating conditions typically used when testing meter accuracy in a shop environment.

Course Breakdown of Topics:

- Subject the meter to Voltage Sags & Swells and observe the results on the meter in addition to the affect this may have on an AMR or AMI module that may be present in the meter.
- Subject the meter to Phase Angle Variances between the current and voltage both leading & lagging in addition to 180 degrees out of phase to represent Net Metering.
- Modify the Nominal Line Frequency of 60Hz from 45Hz to 65Hz and observe results.
- Dropping a Phase of Current for any given phase to simulate a CT with an open secondary or an open wire between the CT and the test switch.
- Introducing Harmonics onto the fundamental 60Hz waveform and observe the results.
- Apply Back Voltage on the load side of a meter with an under-glass service disconnect switch to simulate a backup generator or cheater cord from an adjacent home.
<C:\Users\dan.hollow\Videos\Captures\2990 Static.mp4>



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SIMULATING VOLTAGE SAGS & SWELLS

- Set voltage to 5 volts lower than nominal voltage for the meter to simulate a voltage sag
- Set voltage to 5 volts higher than nominal voltage to simulate a voltage swell
- Lower the voltage to the point at which the meter stops functioning properly simulating a brown out condition and verify that the meter and AMR/AMI recovers when the voltage is set back to nominal voltage conditions.
- Raise the voltage to the maximum voltage allowable based on the operating range of the power supply in the meter under test and observe the results.



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VARYING THE PHASE ANGLE OF THE CURRENT RELATIVE TO THE VOLTAGE

- Set the current phase angle to 60 degrees lagging i.e. .5 power factor
- Set the current phase angle to 60 degrees leading or 300 degrees
- Set the current phase angle to 180 degrees out of phase i.e. reverse current flow
- Set the current phase angle back to 0 degrees or unity power factor of 1



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VARYING THE LINE FREQUENCY

- Set the power frequency to 45Hz then verify that the meter sees the shift in the line frequency
- Set the power frequency to 65Hz then verify that the meter sees the shift in the line frequency
- Set the frequency back to 60Hz
- There should be no effect on the operation of the meter since most meters are designed to operate off of 50Hz or 60Hz



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ENABLING AND DISABLING THE INDIVIDUAL PHASES OF CURRENT I.E. SINGLE ELEMENT TEST

- Disable the current for phase A and note the results seen by the meter
- Disable the current on phase B and note the results seen by the meter.
- Disable the current on phase C and note the results seen by the meter
- Re-enable all three phases of current and set phase A at 180 degrees out of phase to simulate reversed CT secondary wires to the meter



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2990 LCD SCREEN

The screenshot displays the following information:

- TESCO** logo in the top left corner.
- DRIVE ACTIVE** status in large red text at the top center.
- A yellow indicator light with a red circle and the text **DRIVE ACTIVE** in the top right corner.
- FORM:** 9S
- SERVICE:** SP 120 A B C
- WAVEFORM:** TMA MANUAL PAGE
- A table of electrical parameters:

	PHASE A	PHASE B	PHASE C	FREQ.
VOLTAGE:	120.005	120.005	120.005	60.00
CURRENT:	5.00177	0.00000	5.01354	
I PHASE:	0.039	0.000	0.423	

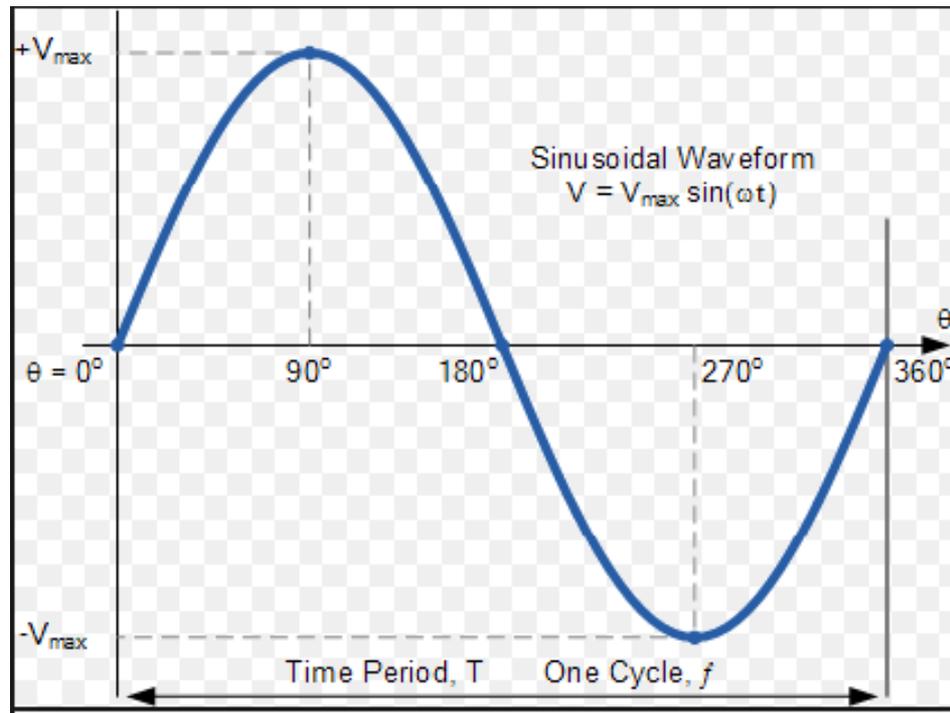
At the bottom left, there is a button labeled **TEMPS.** and three other unlabeled buttons.



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INTRODUCING HARMONICS ONTO THE FUNDAMENTAL 60Hz WAVEFORM

- Add ANSI C12.20 waveforms to the 60Hz sine wave and note that the meter/AMI Head-End sees the harmonics and note if there are any adverse reactions by the meter or the AMR/AMI module's ability to communicate as a result





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APPLING BACK VOLTAGE ...

... on the load side of a meter with an under-glass service disconnect switch and attempting to close the switch contacts

- Open the contacts on the internal service disconnect switch in the meter
- Apply back voltage to the load side of the meter
- Attempt to close the contacts on the disconnect switch and observe the results. The service disconnect switch in the meter should not close under these conditions.



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APPLYING BACK VOLTAGE ON METER WITH DISCONNECT SWITCH IN THE OPEN STATE





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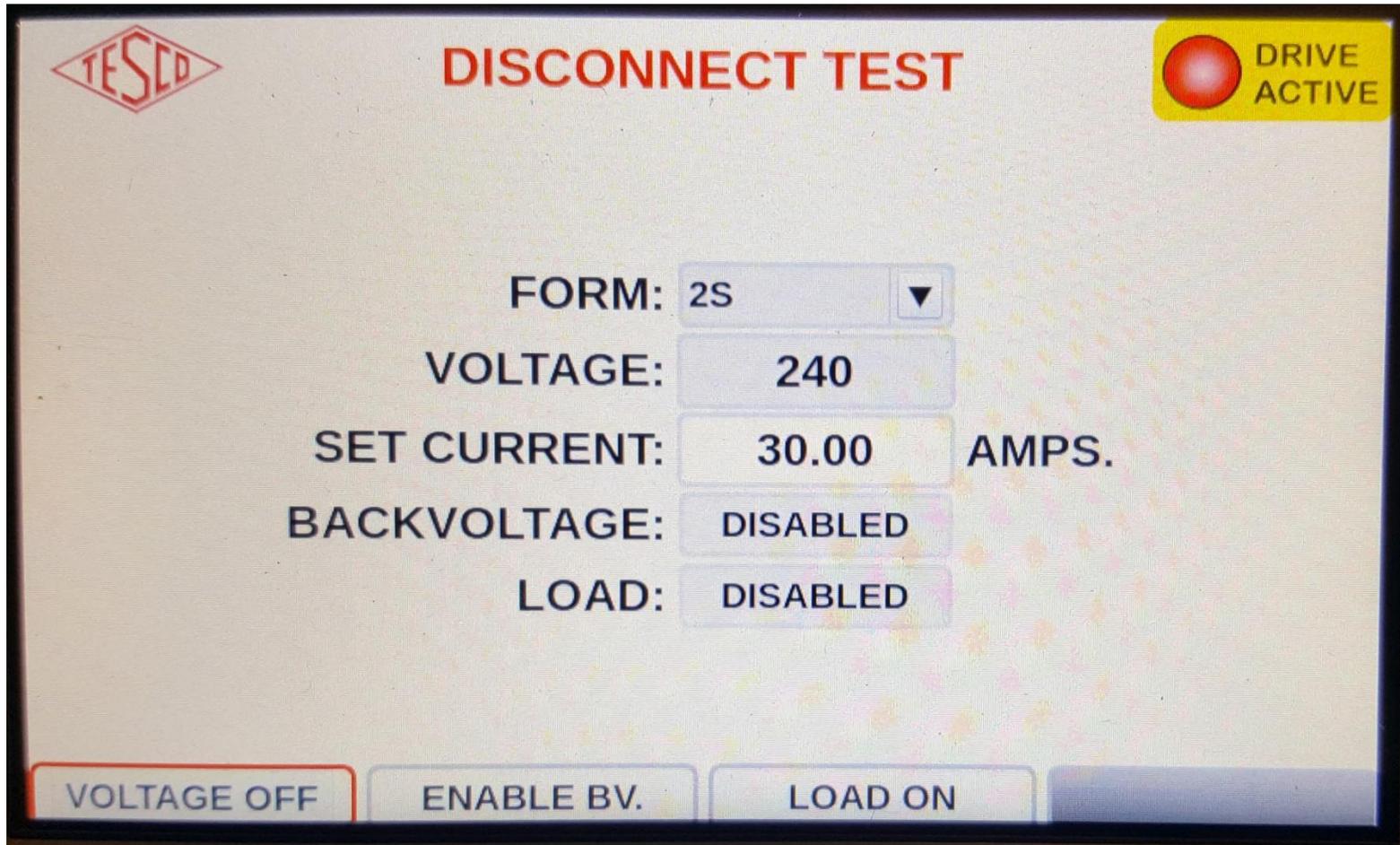
APPLYING BACK VOLTAGE ON METER WITH DISCONNECT SWITCH IN THE OPEN STATE





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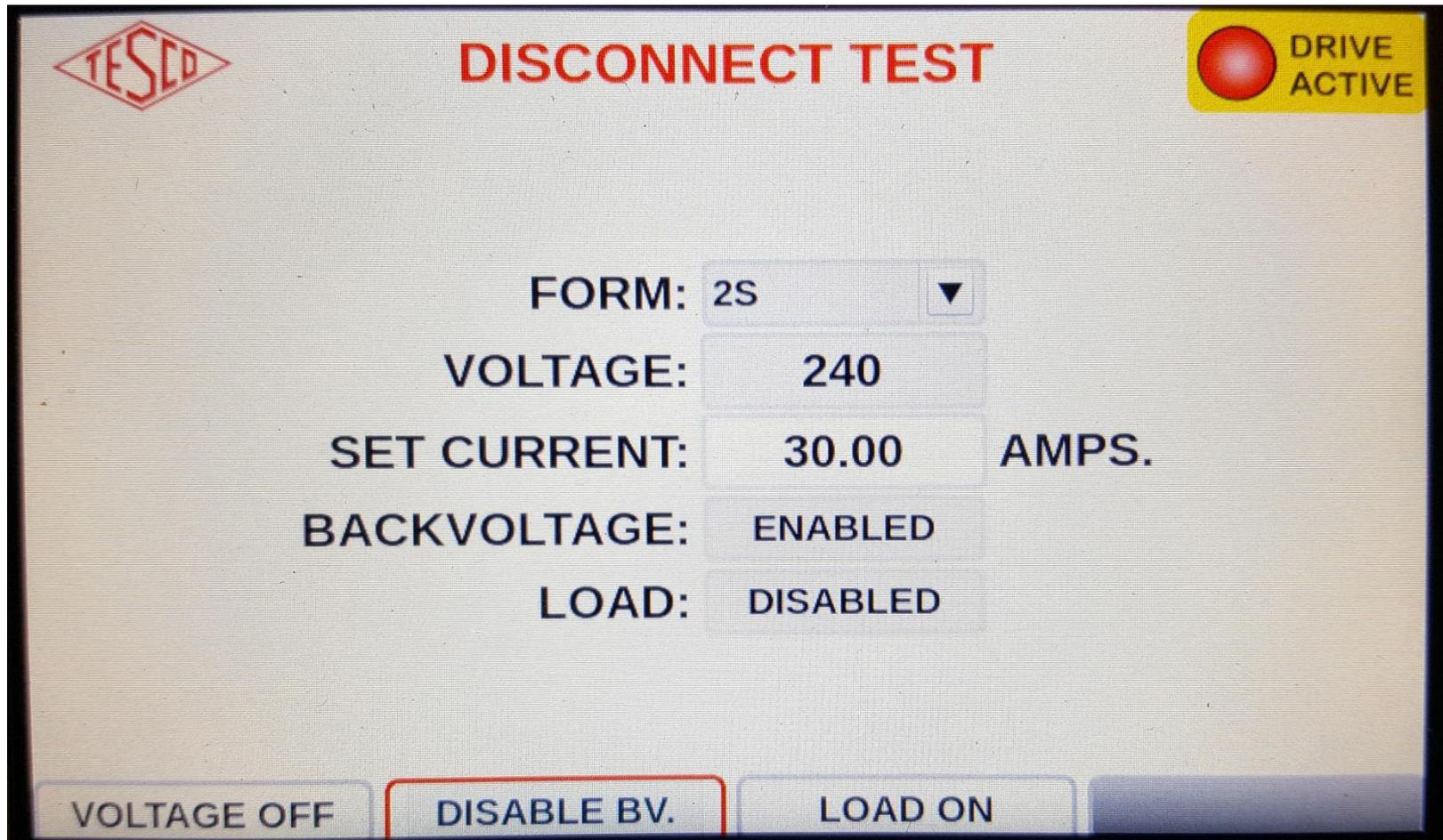
APPLYING BACK VOLTAGE ON METER WITH DISCONNECT SWITCH IN THE OPEN STATE





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APPLYING BACK VOLTAGE ON METER WITH DISCONNECT SWITCH IN THE OPEN STATE





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QUESTIONS AND DISCUSSION

Questions?





WRAP UP / REVIEW

- Why is it important to expose a meter to adverse/real world conditions in a shop environment?
- One reason is to test the meter program to make sure it logs events like voltage Sags & Swells, Poor Power Factor, and the presence of Harmonics i.e. THD
- To confirm that the threshold set for what constitutes as a back voltage is actually set to the desired level
- Verify that the meter logs a loss of a phase or a reversed phase
- Verify that the basic operation of the meter and or AMR/AMI module are not adversely affected by real world conditions
- To test the AMI Head-End Software to see if the conditions you're exposing the meter to is seen by the Head-End Software



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3 MULTIPLE CHOICE QUIZ QUESTIONS

1. What is the fundamental line frequency of a U.S. based utility's distributions system?
 - A. 400Hz
 - B. 50Hz
 - C. 60Hz

2. What would happen if a transformer rated metering installation had an open secondary on one of the CTs?
 - A. The meter would stop working
 - B. The CT would get hot
 - C. The meter would register 1/3 less energy than it should given a balanced load

3. What happens when back voltage is present on the load side of a meter with an under-glass service disconnect switch in the open position?
 - A. Nothing
 - B. The meter would register reverse energy
 - C. The disconnect switch would not close back in





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MORE QUESTIONS AND DISCUSSION



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This presentation can also be found under Meter Conferences and Schools on the TESCO website: tescometering.com

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