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A TESCO COMPANY

New Tools for a Next Generation of Metering – TESCO Solutions

AclaraConnect '19

CONFERENCE AND EXPOSITION



Partners
IN A SHARED VISION

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For Aclara Connect Conference

Thursday, May 23, 2019

11:00 a.m



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AMI and the Need for Increased Validation Testing

- Electro-Mechanical Meters typically lasted 30 years and more. Electronic AMI meters are typically envisioned to have a life span of 15 years and given the pace of technology advances in metering are not expected to last much longer than this.
- This means entire systems are envisioned to be exchanged every fifteen years or so. In the interim the meter population and communication network inherent in the infrastructure for each utility must be maintained.
- Meter communication and meter data management have become as important to metering operations as meter accuracy.
- Firmware upgrades, firmware stability and cyber security have become increasingly important to metering departments
- Meters are being replaced at a far faster pace than meter sockets, bringing things like Hot Socket issues to the forefront



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AMI and the Need for Increased Validation Testing

New Roles for Metering Operations

- Responsible for either reviewing ANSI Tests or even performing some of these ANSI Tests- including, but not limited to:
- Accuracy Tests
- Perform Meter Functionality testing on new and returned AMI meters
- Register and communication module energy measurement comparison
- Disconnect/Reconnect Functionality
- Outage Performance
- Meter Communications Performance
- Consumer safety and combating real and perceived issues
- Near continuous research into the “next” technology and the next deployment



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Next Generation Meter Testing Equipment

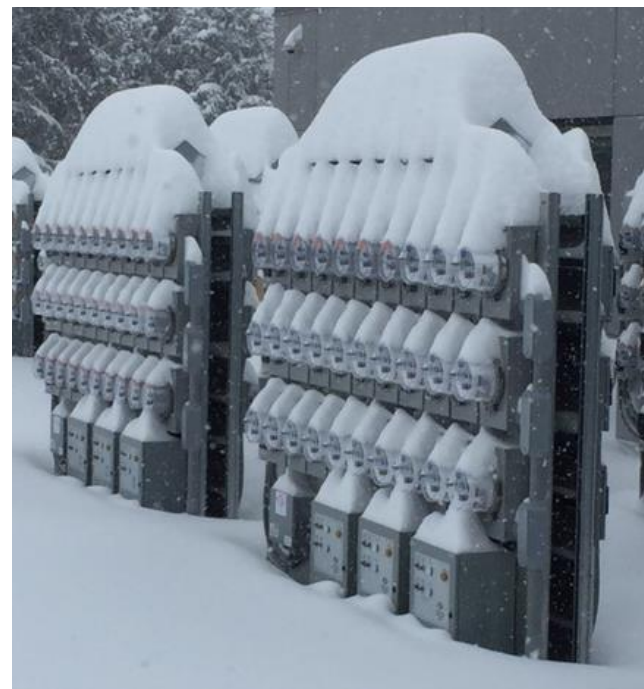
The first Question is really;

Why do we Test?

Because things fail.

Why do we develop protocols?

So we can capture all of the ways that meters have failed in the past and make sure we are rigorously checking them going forward.





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Typical AMI Cycle

Certification Testing – This is not the most detailed testing we will perform on a meter. The goal of this testing is to determine that the meter has the features that the utility is looking for, that the manufacturer says the meter has and that the communication system is working as advertised.

Note: And what are the back up plans? How well does the meter under consideration handle other communication protocols should the primary protocol fail? Can an antennae be added? Cellular solution added? PLC potential?

First Article Testing – This is the most detailed testing that the utility will perform on the meter. What most people do not realize is that the meter manufacturers will be delivering them a series of “First Articles” as the production meter being delivered will change over the course of the AMI deployment.

Pilot Test – This will allow the utility to test the entire system and begin to identify and fill some of the process holes identified.

Do your internal systems need to be upgraded or augmented to allow the system the ability to handle the stress of an AMI deployment?

Acceptance testing – this will be a part of the pilot test

Accuracy testing – the shorter part of the acceptance test

Functional testing – the longer part of the acceptance test

Equipment Used in these phases – Functional Test boards (Meter Qualification Boards), Accuracy Test Boards, Meter Engineering/Demand Boards, Meter Farms, Meter Asset Management and Meter Record System upgrades/replacement

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First Article Testing

Here we are looking at everything

Start with the ANSI tests and even the ANSI folder from the Manufacturer

Take nothing for granted from accuracy at Test Amps to accuracy at light loads and rated loads. Check for performance with sags and swells, disconnect under load and reconnect, ability to detect and not reconnect with back feed, introduce the new ANSI waveforms and monitor performance. Check everything.

Similar tests can and should be developed for the collectors and every other device used to get information from the meter to the head end.





Pilot and Acceptance testing Protocols

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Examples of things to check (i.e. have gone wrong)

The Meter Box label – Company header, meter attributes listed, part # listed, meter model listed

The PO: Line items and descriptions and ID's all matching between the Manufacturer's system and the utilities system. Barcodes include, start and stop on a pallet correct, all bar codes scannable, # of meters on a pallet

Meter Nameplate: Correct format for SN, bar code, part number

Meter File: PO match between manufacturer and utility (down to and including individual line numbers), text file format correct, file format processes in Utility CIS and meter record systems, file can flow to inventory and be released for work management system

Physical Inspection: Pot clips, cover, T seal, hardware version – part number

Power up inspection: Meter connects to network, display works, correct firmware on meter and on communications module; correct settings in meter; energy accumulation working; reverse power working; correct date and time displayed; correct company name displayed; all screens displayed as specified; Validate interval data; DST time change; Simulate time adjustment; validate interval data against meter register; clear billing, interval and event data

Accuracy Test

Voltage Profile

Service Switch – disconnect with load, reconnect with load; attempt reconnect with back feed; switch status displayed on meter





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During AMI Deployment

Acceptance Testing – who is doing this, the utility or the third party deployment vendor? How will test results be transferred if the latter.

Functional Testing

Accuracy testing

Field Audits – are they needed? Who is responsible?

Continued Certification/First Article Testing – does this ever end?

System testing – does this ever end?

What are we looking for/hoping for - Nothing

Equipment Used in this phase – Functional Test boards (Meter Qualification Boards), Accuracy Test Boards, Meter Engineering/Demand Boards, Meter Farms





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After AMI Deployment

Acceptance Testing – this is now the Utility’s responsibility regardless of who performed this function during deployment

Functional Testing

Accuracy testing

System monitoring and population management – this become essential and hopefully, very low key. But always in the background

What are we looking for/hoping for – Nothing again

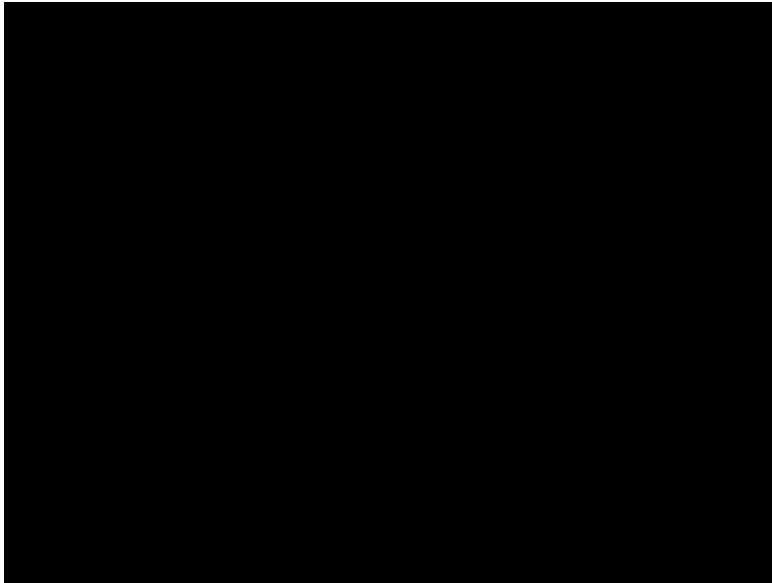
Equipment Used in this phase – Functional Test boards (Meter Qualification Boards), Accuracy Test Boards, Meter Engineering/Demand Boards, Meter Farms





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Hot Socket Repair Kit





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2100 Desktop Meter Station

METER FORMS: FORM SELECTABLE 1, 2, 3, 4, 5/45, 6/36, 8, 9, 12, 14, 15, 16

VOLTAGES: VOLTAGE SELECTABLE 120/208/240/277 VA; 480 VA (OPTIONAL)

DIMENSIONS: 12" X 11" X 10" (STANDARD MODEL); 12" X 13" X 10" (DISCONNECT & BUILT-IN LOAD MODELS) (W X D X H)

Power Line Carrier Capable:

INTERNAL LOAD (CATALOG NO. 2100-I): 0.5 AMP PHANTOM LOAD

EXTERNAL LOAD (CATALOG NO. 2100-E): UP TO 50 AMPS

BUILT-IN LOAD (CATALOG NO. 2100-L): 0, 5 AND 30 AMPS (CUSTOM LOADS AVAILABLE)

DISCONNECT OPERATION (CATALOG NO. 2100-D)

LOAD RECEPTACLE (CATALOG NO. 2100-R): 120 VAC RECEPTACLE

SPECIAL REQUEST (CATALOG NO. 2100-S): CONTACT TESCO TO SPEAK WITH A PRODUCT SPECIALIST

CUSTOM FORMS (CATALOG NO. 2100-F): CONTACT TESCO TO SPEAK WITH A PRODUCT SPECIALIST

480 VAC METER TESTING (CATALOG NO. 2100-V)





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Meter Farms

TESCO has been building Meter Farms since early in this first cycle of AMI deployments.

Over the years we have refined and improved the boards and in true TESCO fashion have been providing an increasing array of features to these meter farm panels so every installation is truly a custom design to the customer's specifications.



We have more meter farm sockets out than anyone in the industry although we recently toured a Meter Manufacturer's Meter Farm that is just slightly older than ours and has over 18,000 sockets. However, adding up all of our meter farm installations across North America – we eclipse even this number – in total, but not at any one location.





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Typical Acceptance Testing

New Meter Acceptance Test Plan- Excel File

- Physical Inspection
- Metrology Verification
- Remote Communications Testing
- Local Communications Testing
- Remote Network Verification
- Alarm Testing
- Voltage Summary Test





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2199 Desktop MQB

2199 Desktop Meter Qualification Board Catalog No. 2199

Providing complete capabilities for

- evaluating meters and communications performance

The 2199 provides every option possible on TESCO's 2100 Desktop Meter Station plus much more including:

- generate any voltage and load conditions the meter may encounter in the field
- Apply non-sinusoidal voltages with complex load waveforms
- Perform disconnect tests and reconnect tests without having to worry about being able to drive the meter's switches
- Voltages that are completely programmable from 30-350 volts phase to neutral.
- Loads that are completely programmable from 0-50 amps
- Standard disconnect/reconnect testing
- A zero insertion force socket (electrically operated)
- The most lightweight and portable desktop meter station available





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2990 Desktop Meter Test Station

2990 Desktop Meter Test Station Catalog No. 2990

TESCO introduces a state-of-the-art meter accuracy testing in an affordable desktop configuration!

The 2990 revolutionizes meter testing by providing full series parallel meter testing in a small, budget-friendly desktop package.

A fully ANSI compliant test board, the 2990 offers complete testing of all meters under the widest range of test conditions.

- The new waveform generator has all waveforms called out in ANSI C12.20-2015 (pub. 4/2017).
- All common electromechanical and solid state meters up to 50 amps can be tested with the 2990
- 0.04% TESCO Standard Traceable through NIST





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MTS-3050

Three Phase Meter Test Board (MTS-3050)

An innovative meter ACCURACY test system offering unsurpassed functionality and ease of use. All of the features you will need to test meters today and tomorrow are standard.

Run standard meter accuracy tests and complex meter accuracy tests under widely varying loading conditions with TESCO's MTS-3050.

Features include:

- **THREE PHASE ACCURACY TEST BOARD**
- 0.04% accuracy
- Current Drive: Single range 0.01 to 50A(rms), 70A (peak)
 - with options to go up to 200 amps
- 30 to 350v phase to neutral and 50 to 600v phase to phase
- Ability to check meter response to:
 - Varying loads over long periods of time to simulate brownout and surge conditions
 - Harmonic waveforms (can download custom harmonic waveforms through PC interface)
 - Meter power on/off cycling
 - Phasor Distortion



The MTS facilitates these meter shop functions:

- Full functional testing capability for all AMI/AMR meters
- Meter program updates
- Software revision checking for both the meter and the communications module
- Communications module troubleshooting
- Checking of problem meters for open/shorted elements





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Meter Qualification Board



Next Generation Meter Qualification Board

- Three Flavors to fit a variety of budgets and functional needs:
 - Three Voltages and one current
 - True Series Parallel
 - True Three Phase
- Stock configurations of Master and slave modules to allow for faster delivery for those difficult to meet year end budgets
- These boards can be banked together to provide any number of sockets required. Disconnect testing is standard on all TESCO MQBs and each socket position is designed to accommodate any meter form requested.
- Power up and apply load to electric watt-hour meters for functionality testing with TESCO's multi-position Meter Qualification Boards (MQBs). These boards assist with AMI Meter Certification process and AMI meter qualification and communication testing.
- The new waveform generator has all waveforms called out in ANSI C12.20-2015 (pub. 4/2017).





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MQB3



Three Phase Meter Qualification Board

Apply true three phase voltage and current to electric meters, enabling them to be tested under all possible conditions that may be encountered in the field with TESCO's MQB3.

The MQB3 facilitates the following meter shop functions in high volume:

- New AMI/AMR meters settings check-out
- Meter program updates
- Software revision checking for both the meter and the communications module
- Communications module troubleshooting
- Checking of problem meters for open/shorted elements

With the MQB3, the user has the ability to check meter response to:

- Varying loads over long periods of time to simulate brown out and surge conditions
- Harmonic waveforms (can download custom harmonic waveforms through PC interface)
- Meter power on/off cycling
- Phasor distortion





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MEB

Meter Engineering Board (MEB)

The Latest Generation of TESCO Demand and Time Run Boards with a lot more under the hood

All of the functionality of the Meter Qualification Boards (MQB's) including the new automated meter socket design, disconnect testing, communication testing, and advanced functional tests with TESCO's Meter Engineer Board plus the ability to run Demand and Time Run tests. These boards have basic metrology of 0.1% accuracy traceable back through NIST. There is a Series Parallel version and a True Three Phase version.

TESCO's MEB can help with:

- Meter evaluating testing and certification
- Communications performance
- Power Line Communications testing
- Software and firmware verification
- Meter setting verification
- Meter functional testing
- Demand testing for Utility Commission compliance and meter certification testing
- Time-run Testing
- Extended use testing
- Meter disconnect switch testing





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Multi-Position Meter Test Boards and MQB-MTS Hybrid Boards

Three Phase Meter Test Board

Of course we can take this three phase test board and can make a multi-position of up to three sockets per cabinet which allows us to stock these modules and provide these test boards in just a few weeks once again allowing us to meet difficult end of year budget cycles.

But we can also mix and match our MTB's (Meter Test Boards) with our MQB's to better match testing time and better meet your budgeting requirements.

We can provide better cost per test socket and provide more of the lower cost sockets for tests that take longer to run and provide only one or two of the Three Phase Accuracy test sockets (standard 0.04% accuracy) allowing a far greater bang for your buck.





Test Sequencing on Next Generation Equipment


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TESCO Test Manager

MAY. 19, 2019 - 02:45:41 PM | SETTINGS | SYNC DB | Version: 1.1.0 | John

SCAN / REFRESH

ALL OFFLINE IDLE READY TESTING DONE

OFFLINE
 Production
 MODEL: MTS-3050
 SYS SN: MTS-00000015
 OFFLINE

METER DATABASE | WAVEFORM SETUP | **TEST SEQUENCE**

TEST SEQUENCE LIST

SEQUENCE 4W,WYE FL, LL, FLPF @TA, SINUSOIDAL, ACCURACY [CANCEL] [NEW] [COPY] [SAVE] [DELETE]

SERVICE 4-Wire, Wye [IMPOSITE ERROR P/F LIM 0.500%]

	TEST TYPE	TAG	WAVEFORM SETUP	TOLERANCE	TIME (hh:mm:ss)	# OF TESTS	PULSES RFVS	WEIGHT	INTERVAL (hh:mm:ss)	SUBINT (hh:mm:ss)	SYNC TO CLOCK
1	ACCURACY	FL	4W,WYE FL 120V, @TA PF=1 SINUSOIDAL	0.500%		1	5	3.000			
2	ACCURACY	LL	4W,WYE LL 120V, @0.1TA PF=1 SINUSOIDAL	0.500%		1	1	1.000			
3	ACCURACY	FLPF	4W,WYE FLPF 120V, @TA PF=0.5 SINUSOIDAL	0.500%		1	3	1.000			

DEVICE HISTORY

Windows taskbar: 2:45 PM 5/19/2019





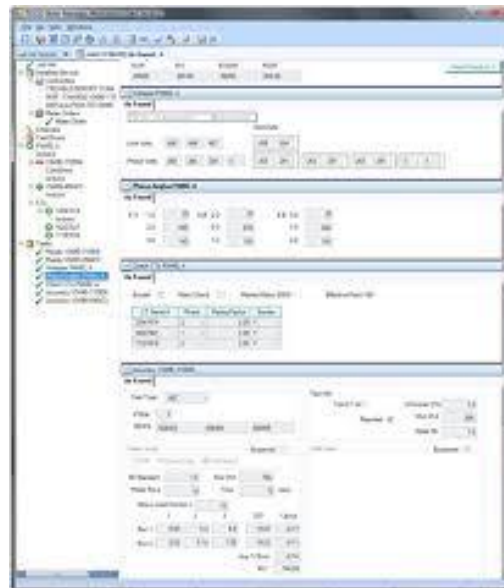
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Meter Manager Software

Meter Asset Lifecycle Management allows your organization to properly manage ALL of your metering assets from cradle to grave.

TESCO offers you a complete product line that supports your revenue, operations, revenue protection and monitoring meter devices including:

- Inventory
- Accuracy
- Sample/AQL Testing
- Communications performance
- Firmware version
- Programming parameters
- Complete record of each metering device
- Regulatory Compliance





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Safety Disconnect Device



- Open the remote disconnect switch on any meter
- Close the remote disconnect switch on any meter
- Leave the meter in the socket during disconnect/reconnect
- Allow meter to be installed with switch open, for safety and arcing
- Save time and money sending techs out in the field
- LEDs show status of Safety Disconnect Device
- Read date and time of open/close along with meter serial number, or meter ID
- Read data out via USB interface for data logs, times, and voltage





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Field Testing Equipment

- Field Test Kits
 - Load Boxes
 - 2200 Series
 - CT Burden Testers
- Phase Sequence Indicators
- Phase Angle Meters
- IR Optical Pickup
- Click Switch
- “Duckbill” Plugs
- Test Switch Isolators
- Hot Socket Gap Indicator
 - Safety Clips





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Consumables

- Seals (Padlock, Demand, and Cable Types)
 - Disconnect Sleeves
 - Socket Jumper Covers
- Socket Blank-out Covers
- Test Switch Protectors
 - Jumpers:
 - Load-to-Line
 - H-jumpers
 - Horn Bypass
 - A-base and Potential
 - Fused Potential
 - Safety Test Switches
- Pre-wired Meter Enclosures
 - Transockets





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Services

- ✓ Accuracy Testing
- ✓ Acceptance Testing
- ✓ Disconnect Testing
- ✓ Retirement Testing
- ✓ Certification Testing
- ✓ Re-Flashing/Re-Programming
- ✓ AMI Support
- ✓ Meter Engineering Support





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TESCO's Users Group

June 9-12, 2019

Philadelphia, PA

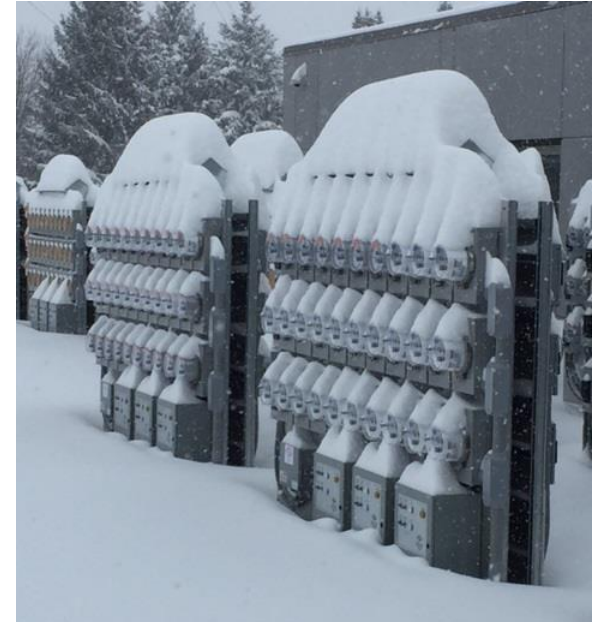
- Learn and discuss new TESCO technology and products through interactive sessions and hands-on training with TESCO engineers.
- NEW training sessions for the new Meter Shop and Lab Equipment
- Current AMI Topics and Practices for First Deployments
- Meter Manager Software sessions including asset management tracking, in-service testing, and kiosks.
- Tour of TESCO's facility
- Dinner with the founding fathers and tour of historic district





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Questions and Comments



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