



THE EASTERN SPECIALTY COMPANY



A TESCO COMPANY

NEW Meter & Transformer Test Equipment

Prepared by Tom Lawton

For New York State Electric Meter Engineers Conference

Manufacturers Presentation

Wednesday, October 17, 2018

11:00 AM to 12:00 p.m.



THE EASTERN SPECIALTY COMPANY

Next Generation Meter Testing Equipment



- Multi-Position Qualification Boards
- Meter Engineering Boards
- Single and Multi-Position Test Boards





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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)

TILT CHASSIS (CATALOG NO. 2100-T): TILTS TO VERTICAL FOR ELECTROMECHANICAL METERS

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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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





THE EASTERN SPECIALTY COMPANY

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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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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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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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.

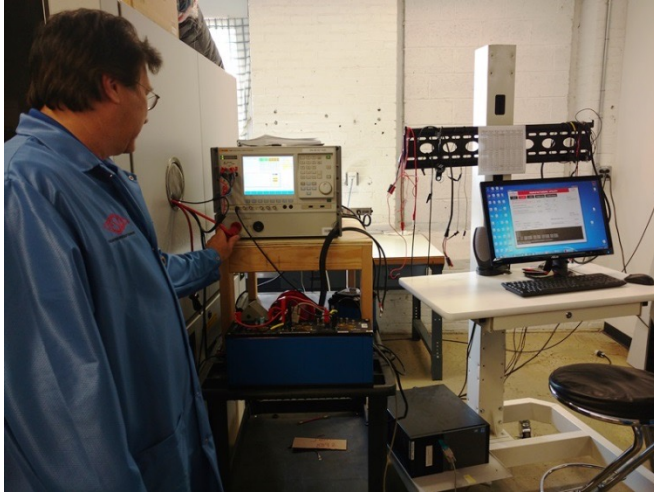
We can provide better cost per test socket and provide more of the lower cost sockets for tests that take longer to run and provide only one or two of the Three Phase Accuracy test sockets (standard 0.04% accuracy) allowing a far greater bang for your buck.



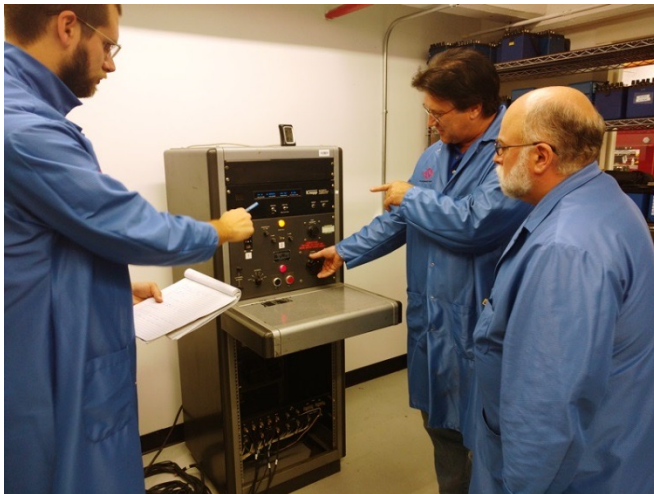


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ISO 17025 Lab



TESCO has been working throughout 2018 on our ISO 17025 Accreditation for our Calibration Lab in Bristol. We believe that this accreditation will provide additional confidence and rigor to our standards calibration and measurement capabilities for ourselves in our continual development environment as well as for our customers who rely on us to calibrate TESCO and other energy measurement equipment.



We are also working hard to obtain the same accreditation for our west coast lab at our Knopp facility where we both manufacture and provide calibration services for our transformer testing customers. Both our Bristol PA and our Emeryville CA facilities will have the same capability for testing and providing traceability to an international standard for Transformers and Transformer testing equipment but also for meters and meter testing equipment. This is providing us with both redundancy as well as more options for our customers.





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Precision Multirange Current Transformer

P-5000 (and P-12000)

The P-5000 and P-12000 Precision transformers are laboratory standards. These unit's excellent accuracy and the Knopp One-to-One calibrating feature make these precision transformer well-suited as a standard for calibration work. These transformer Standards can provide a very accurate determination of the ratio and phase angle characteristics of current instrument transformers having ratios from 5 to 5,000 amperes for the P-5000 and up to 12,000 amps for the P-12000. These transformers can also accurately extend the range of a 5 ampere ammeter or wattmeter to cover all current values up to 5,000 and 12,000 amps respectfully.

The P-500 provides eight self-contained primary ranges from 5 to 100 amperes. These ranges are brought out to binding posts on the top of the transformer. A 240 turn secondary is provided for use with these primary taps; other secondary taps are provided for other ranges. Ranges above 100 amperes are obtained by passing a primary conductor through the transformer window. Various primary ranges are obtainable by varying the number of through-turns and choosing from among the available secondary taps. The P-12000 operates in a similar fashion and all are traceable back through NIST.



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Current Transformer Testing System

KCTS-8000

The Knopp Current Transformer Testing System (Type KCTS-8000) is designed to measure the accuracy of instrument transformers having 1 or 5 ampere secondaries and primaries of up to 8000 amperes. The system uses a high accuracy multi-range current transformer as a reference standard. All ANSI standard burdens are included. The phase angle and ratio errors of the transformer-under-test (TUT) are measured by the built-in Knopp Automatic Transformer Comparator.





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Current Transformer Testing System

KC-1500

The Knopp Type KC-1500 Current Transformer Testing System is designed to measure the accuracy of instrument transformers having 1 and 5 ampere secondaries and primaries of up to 1500 amperes. The KC-1500 is capable of testing transformers with 1 or 5 ampere secondaries. The system uses a high accuracy multi-range current transformer as a reference standard.

The system is well suited for utilities whose current transformer testing needs include primary currents up to and including 1500 amperes. The phase angle and ratio errors of the transformer-under-test (TUT) are measured by the built-in Knopp Automatic Transformer Comparator.





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Automatic Transformer Comparators

The Knopp KATC Automatic Transformer Comparators (KATC series) provide the most convenient means available to measure instrument transformer ratio and phase angle errors. Some of the comparator features are:

- Reduced testing time - test results are typically available within three seconds
- Automatic operation (no manual "nulling" or adjustments required)
- Microprocessor control
- Auto ranging capability
- Digital display
- Calculation and display of ANSI accuracy class
- Fully protected circuitry
- RS-232C output
- Interchangeable with other Knopp comparators



KATC-C



KATC-C1

The KATC-C1 Automatic Transformer Comparator is an enhanced version of the popular KATC-C Comparator. Features of the KATC-C1 include:

- The ability to test transformers with 1 or 5 ampere secondaries
- Automatic sensing of 50 or 60 Hertz current
- Improved data handling capabilities including the ability to be controlled by a remote computer
- Improved resistance to damage from excessive test current



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Precision Multirange Voltage Transformer

This Type WP-14000 Transformer is primarily a laboratory standard. Its excellent accuracy and the Knopp one-to-one calibrating feature make it well-suited as a standard for precision calibrating work. This transformer makes possible very accurate determination of the ratio and phase angle characteristics of voltage instrument transformers having ratings from 120 to 14,400 volts. This transformer also makes it possible to accurately extend the range of a 120 volt voltmeter or wattmeter to cover all voltage values up to 14,400 volts.

The WP-1400 Transformer, like other Knopp Precision Multirange Transformers, has excellent ratio and phase angle characteristics with respect to both inter-range accuracy and overall accuracy. This is made possible through a properly engineered design and through exclusive, highly perfected compensating and winding methods.





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Voltage Transformer Testing System

KVTS

The Knopp Voltage Transformer Testing System is designed to measure the accuracy of instrument transformers having 120 volt secondaries and up to 14,400 volt primaries (special order for up to 36,000 volt primaries is available). The system includes a control console which contains the control circuitry, ANSI standard burdens, and the Knopp Automatic Transformer Comparator. The Knopp precision and loading transformer set is also included (as pictured) and is connected to the console via a special cable.





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ANSI Standard Burden Sets

Testing and calibrating instrument transformers often requires standard burdens of reliable accuracy and stability, and burdens that are immune to stray fields and harmonics. The burden sets Knopp offers have been carefully designed to meet these requirements. They provide the standard burdens required for the testing of current and voltage transformers for metering service, and for the testing (within the current rating provided by the sets) of current transformers for relaying applications, all as called for by ANSI/IEEE C57.13-2016.

All the current burden sets are designed to be used with external leads consisting of a 5-foot pair of #8 copper conductors. This becomes very significant at the lower burden values, since the external leads constitute a significant part of the total burden.

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ANSI Standard Burden Sets ***Voltage and Current***





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Loading Transformer: CL-6

This readily portable Knopp Loading Transformer weighs only 60 pounds and measures 12" long, 9" wide, and 10" high. Its sturdy enclosure provides protection and adequate ventilation. Two convenient carrying handles are provided.

The insulating terminal panel is rigidly secured to the transformer frame, and heavy-current, bus-bar-type terminals are securely bolted to the panel. The two output terminals each have two connection surfaces, one on a vertical plane and one on a horizontal plane, for maximum convenience in connecting the heavy current leads and in changing, when necessary, the series-parallel links. The links and the output connections cannot interfere with each other. All terminals and connection links are plated

Both the primary and the secondary are insulated for a 4,000 volt, 60 cycle, one-minute test. A grounding stud is provided on the enclosure.





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Meter Manager Software

- Over the past four years we have added over 25 million meters managed along with CT's, PT's, AMI hardware, rubber goods, tools as well as user defined materials
- Our team has been built out along with the product and over the past three years we have performed two 5 Million plus end point installations with both meeting every milestone and both going on time and on budget
- Meter Manager is considered a "Best of Breed" and is being used as a bolt on to SAP, Maximo, and Oracle CC&B
- Meter Manager is a Scalable Enterprise Ready system that has High Availability, Load Balancing, and seamless Fail Over
- Larger users have nearly a thousand active users
- One application replaced a deeply embedded system that had been installed for over 30 years and had over 70 interfaces. This utility paid an independent party over six figures to perform a sophisticated security penetration analysis. After completing the testing, hacking and analysis a single recommendation was made and implemented for what was defined as a "small vulnerability".





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Meter Manager Software

New Ways in Which Meter Manager is being used;

- Meter Manager will be used on tablets to manage an AMI Field Deployment starting in the first quarter of 2019. This will be the largest utilization to date of the Site Verification module.
- Meter Manager is being used as the system of record for CT and VT site information for a multi-million meter utility. Their MDM queries Meter Manager for transformer information to check on billing. Unusual wiring parameters for specific sites are stored in meter manager along with all CT and PT ratios so billing multipliers can be calculated and periodically checked as a system against the billing system to ensure that clerical errors do not lead to billing errors.



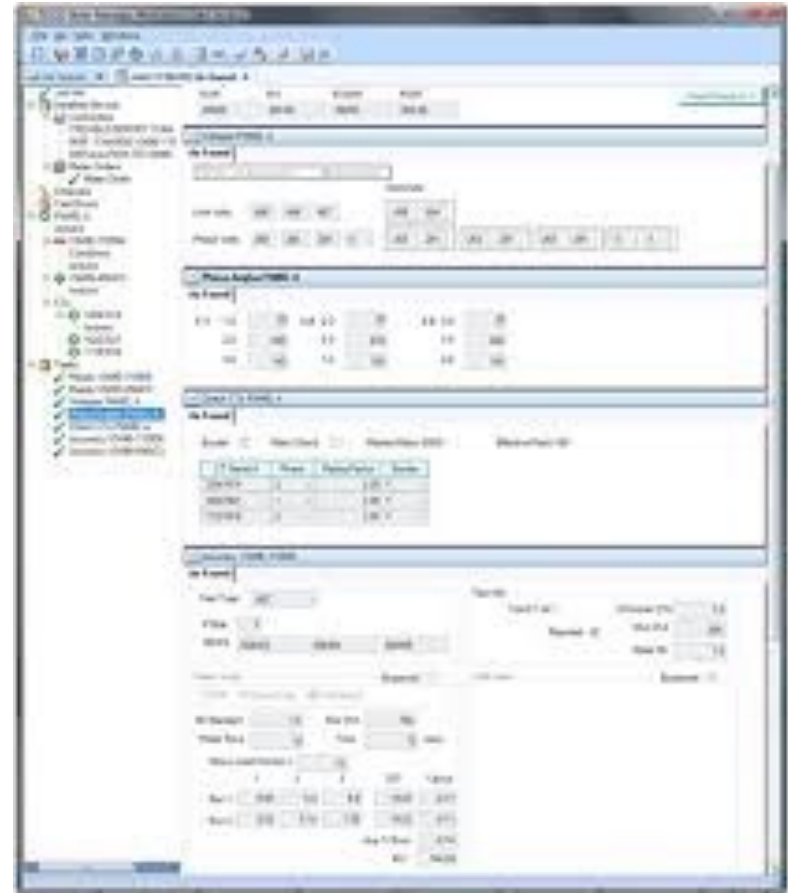


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Meter Manager Software

Basic Modules of Meter Manager

- Meter Shop
- Meter Inventory
- Meter Records
- Random Testing
- In-Service Testing
- PPE Inventory and testing
- Tool Inventory and Testing
- Field Verification Module
- Total life cycle asset management for everything metering





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Training Room



TESCO is the leader in Meter Training Boards and Meter Training Rooms.

Instructors can set errors in a safe and consistent manner.

Equipment can be used for new training or refresher training.





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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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Hot Socket Repair Kit





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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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Voltage Tester: K-60

FOR AC AND DC 120 TO 600 VOLTS

CAT III RATED UL 61010-1

K-60 KNOPP VOLTAGE TESTER for AC and DC with polarity indicator.

Double safety indication is by solenoid and by neon lamp.

Knopp Voltage Testers offer portability and ease of use with full protection.

These exceptionally versatile and useful tools are backed by a reputation for quality in the design and manufacture of electrical test equipment

Knopp Voltage Testers are designed and built with safety, the **key** criteria!

Dual voltage indication is provided by solenoid and neon lamp, operating **independently**. The lamp gives a bright warning signal. Voltages are shown by a positive, easy-to-read, moving indicator. There is a signal by hum and vibration; and the user is protected by high-grade, properly applied insulation, and by separation of incoming leads (the do not cross over each other within the housing). Interior separation of the circuit is a basic design feature of the case.

Nylon insulation covers prod tips to within 9/16" of end to prevent shorts across tips. The K-60 has no exposed metal parts. The scale and plate are both of insulating material.

Each K-60 order includes the K-60 voltage tester, Cordura carrying case, and leads.





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Phase Sequence Indicator

ROTARY TYPE • NO LAMPS • RELIABLE
□ • RUGGED • VERSATILE • TIME SAVING

POSITIVE, STRAIGHTFORWARD SEQUENCE INDICATION IS PROVIDED over a wide variety of voltage and frequency by direction of rotor rotation. No need for range switching or terminal charging. Also indicates an open phase.

MODEL K-3: 60-600 volts, 25-60 Hz

MODEL K-6: 24-480 volts, 400 Hz

Use of the Knopp Phase Sequence Indicator saves man-hours and protects valuable equipment against damage. It pays for itself in a short time.





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Third Rail Tester: 4E2-1

The Knopp 4E2-1 Voltage Tester is designed to detect electrical potential (voltage) between the third rail and ground on high voltage electrified transit systems. Two, redundant neon bulbs are used to indicate the presence of voltage.

Features of the 4E2-1 include:

- Can be used on AC or DC
- Can be used up to 1,500 volts
- Can span a distance of up to four (4) feet
- Uses a dual neon lamp principle for double safety protection





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TESCO's Users Group

June 9-12, 2019

Philadelphia, PA

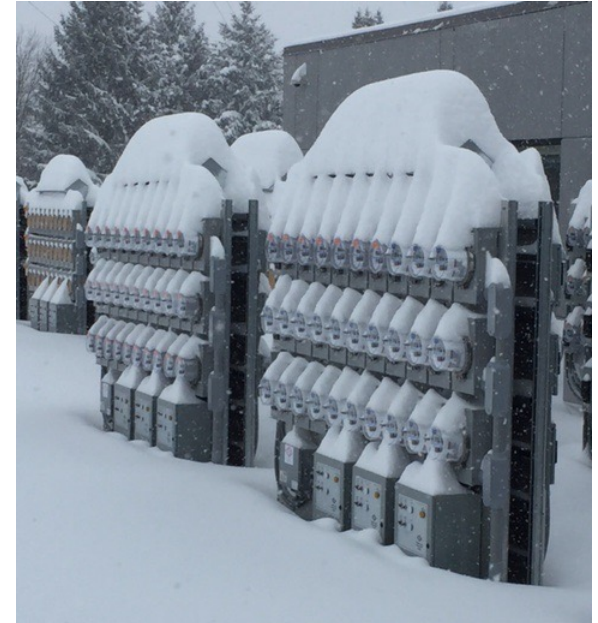
- Learn and discuss new TESCO technology and products through interactive sessions and hands-on training with TESCO engineers.
- NEW training sessions for the new Meter Shop and Lab Equipment
- Current AMI Topics and Practices for First Deployments
- Meter Manager Software sessions including asset management 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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