

#### Fundamentals of Field Testing Meters

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#### **CARIBBEAN METER SCHOOL**

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## Why Do We Test Meters?





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### We Test for Several Different Reasons

- Acceptance testing from Meter Manufacturers (Trust but Verify)
- Ensure Accuracy of our Meters
- Comply with PSC requirements
- Verify the integrity of a new Metering Installation
- Verify the integrity of our existing Metering Installations
- Satisfy Customer High-Bill inquiries



## What Kind of Tests Do We Do?

- Complaint Test:
  - High Bill Inquiry
- Installation Test:
  - Any new Trans-Rated Metering Installation
- Periodic Test:
  - All existing Trans-Rated Metering Installations
- Sample Test:
  - Required by the PSC
- Acceptance Test:
  - Shop testing new and returned meters



#### Test Amps & Meter kH



TA (test amps) is the test load recommended by the manufacturer for the full-load test. This meter should be tested using a 30 amp load for the fullload test and a 3 amp load for the lightload test.

On mechanical meters, the kH is the amount of energy required to rotate a meter's disc one revolution.

On electronic meters, the kH is the amount of energy represented by each test pulse.

One test pulse from this meter represents one watthour of energy.

The kH is used to calculate revolutions of the standard.



#### *Test Amps for Transformer Rated Meters is typically 2.5 amps*

ANSI Code for Electricity Metering states that Test Loads for T.R. Meters may be 100% of the Secondary Current Transformer rating for Full Load, and 10% of rating for Light Load.

Full Load may be tested at 5 Amps Light Load may be tested at .5 Amps





#### **Calculating Load on Electronic Meters**

### <u>3600 x Kh x Meter Multiplier</u> = Watts Seconds per Revolution



#### **Determining Load on a Mechanical Meter**

The Load on Mechanical Meters can easily be calculated by timing the meter's disk and solving the formula shown below.





#### **Determining Load on a Sensus iCon Meter**



• Each increment of the line segment represents one Kh value.



#### **Determining Load on an Elster Meter**



- The black square indicates load on an Elster meter.
- The time from the instant that the square first appears, goes away, and then reappears represents one Kh value.



#### **Determining Load on a Landis + Gyr Meter**





• Landis + Gyr meters have two short line segments that move across the bottom of the display.

• When the two line segments make a complete trip across the display, one Kh value of energy has been consumed.



## **Overview of Field Test Methods**



## Equipment



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#### **ACCURACY REQUIREMENTS**

#### ANSI C12.1-1995

#### Test Loads

Full Load  $\approx 100\%$  of Test Amperes at unity power factor Light Load  $\approx 10\%$  of Test Amperes at unity power factor Power Factor  $\approx 100\%$  of Test Amperes at 50% power factor (Test Loads for T.R. Meters may be 100% of Secondary Current Transformer rating for Full Load and 10% of rating for Light Load.)

#### Acceptable Performance

Average Percent registration shall not be less than 98% or more than 102% Avg % Registration =  $\frac{FL + LL}{2}$  Weighted % Registration =  $\frac{4FL + LL}{5}$ 

#### Adjustment Limits

Adjustments are required when error in registration exceeds 1% at Light Load and Full Load or 2% at Power Factor.

Meter accuracy shall be adjusted as close to 100% as practical.



## Comparison Test Using a Portable Meter Test System

- Test Jack, Watthour Standard and Current Synthesizer in one lightweight unit.
- No setup wiring is needed.
- Simple to use, even for non-metering personnel.



- Limited Use
  - Some units are limited to Single Phase meters only.
  - Others will test all Self-contained and Transformer Rated meters except the 5S/35S/45S.



RM-1

#### Comparison <u>Check</u> Using a Second Watthour Meter

- Easy and inexpensive way to handle high bill complaints.
- A control meter, with known accuracy is placed in series with the customer's meter using a duplex adapter.
- The control meter is left in place for a sufficient period of time (i.e. one week).
- Readings on both meters are recorded when the control meter is installed and when removed.
- The accuracy of the customer's meter is calculated from any difference in consumption.







#### Radian RM-17

- Tests Single Phase Self-Contained watthour meters.
- *Meter Forms* 1S, 2S, 2SE, 12S and 12SE.
- Closed link meter testing.
- Produces 0.2 50 amps current.
- Operates on any AC voltage source (60 to 600 volts).
- Tests Full Load, Light Load and Power Factor





#### Radian RM-17

- The socket adapter jumps the Customers service when installed but the front of the adapter remains deenergized.
- Programmed with default Meter Forms, Kh values and tests.
- Customizable program to create new or edit existing tests.
- Once test is chosen select Run Test. The meter will power up and the test will start.
- Test results will provide FL, LL, PF and Weighted Accuracy Average.





#### ProbeWell MT-1/NT9

- Portable 3 Phase watthour meter tester.
- Tests meter forms: 1S, 2S, 2SE, 3S, 4S, 6S, 8S, 9S, 12S, 12SE, 14S, 15S, 16S and 16SE
- Does <u>NOT</u> test a 5S, 35S or 45S
- Closed link testing.
- Capable of producing 0.25 to 50 amps of three phase current.
- Operates on any AC voltage source (100-600 volts).
- Test results will provide FL, LL, PF and Weighted Accuracy Average.

• Reverse power flow capability for bidirectional solid state meters.





#### ProbeWell MT-1/NT9

• Set the Form Selector switch on the back of the adapter to the correct form and move the twist spades to the correct location.

• The socket adapter jumps the Customers service when installed but the front of the adapter remains de-energized.

• Choose the Preset-Quick, Preset-Full test or select User-Defined Test.

- If either Preset Test is selected the unit will determine the type of service and meter form installed.
- When the optical pickup is used testing a solid state meter the test becomes fully automatic after the power switch is turned on.

• Once the test is complete the results page will display the FL, LL, PF and Weighted Accuracy average.







#### **Powermetrix Automated Meter Tester**

- Tests most ANSI socket based meters.
- Closed link meter testing
- Synthesized voltage & up to 30 amps current source.
- Operates on any AC voltage source (100 to 530 volts).
- Test Wh, VARh, VAh





#### Radian Portable Three-phase Meter Tester

- Tests most ANSI socket based meters.
- Closed link meter testing
- Synthesized voltage & up to 50 amps current source.
- Operates on any AC voltage source (90 to 300 volts).
- Test Wh, VARh, Vah
- CT Burden & Ratio
- Site Analysis





#### Meter Tester / Site Analyzer

- Capable of Customer Load or Phantom Load Testing
- Available with built in Phantom Load for when there is little or no customer load, or whenever an ANSI compliant test is desired.
- A true Three phase voltage source is also available.
- CT Burden & Ratio, Service Vector Analysis, Harmonic Analysis

WECO WE-20 from Radian

"Portable Three-Phase Meter Tester / Analyzer" Powermaster from Powermetrix

"Portable Three-Phase Meter Tester / Analyzer"



Meter Test Adapter is available





## Field Testing Using Customer's Load



#### "CURRENT RETURN SWITCHES"



- Each current return switch has a spring loaded contact into which the current probe from the test equipment is inserted.
- The spring contact is designed to make the circuit through the test equipment before it breaks the contact through the test switch. This guards against accidentally opening the CT secondary circuit.
- The current probe from the test equipment has two contact surfaces with an insulator in between. GPC's test equipment requires the copper contact to be up and the tin plated contact to be down so that the current flows in a forward direction through the test equipment.



## CUSTOMER LOAD TESTING AND SYSTEM ANALYZERS







testMET Gold Miner



**PowerMetrix** 

PowerMaster





#### **Comparison Test Using Customer's Load**

- Test equipment is put in series with the customer's load.
- Meter continues to register No need to put meter in Test Mode.

Radian Research RD-30 Three Phase Analyzing Standards

#### *Powermaster "Portable Three-Phase Meter Tester / Analyzer"*



In addition to meter accuracy tests:



- CT burden and ratio test
- System wiring verification
- Harmonic analysis



### **POWERMETRIX – POWER MASTER**





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#### **SAFETY IS THE ABSOLUTE NUMBER ONE PRIORITY**

#### Always use your Personal Protective Equipment

- Hard Hat
- Safety Glasses
- FR Clothing
- Dielectric Gloves with "Grabbit" or Leather Protectors































#### OUR EXPERTS ARE HERE TO ANSWER ALL OF YOUR QUESTIONS.





# The End



Always remember, fuses are your friend.

