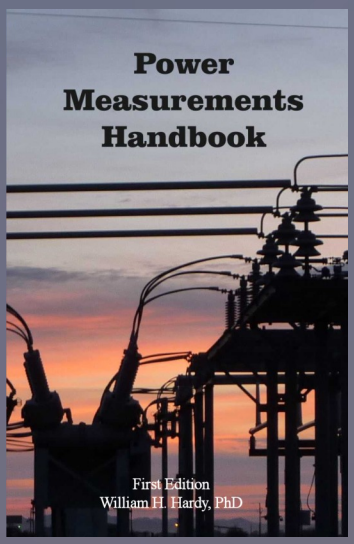
Power Measurements Training Programs

Does your company have challenges in training its metering employees?

Power Measurements can offer an effective alternative to both internal training and meter schools.

Does dedicating expert internal resources for course development make sense?



Power Measurements' courses have been developed based on over a decade of participation at major meter schools by Dr. Bill Hardy. They embody Dr. Hardy's extensive experience in the field of power measurement. Course's can be tailored to your exact needs. The full course outline is presented on the back of this flyer. The full course takes approximately two days. Abbreviated versions can be provided. Each student receives a copy of the *Power Measurements Handbook* which provides a pocket reference for much of the material in the course.

Are meter schools the most effective way to educate your employees thoroughly and completely in minimal time?

The strong point for meter schools is their ability to very effectively expose employees to a wide variety of points of view. Their weak point is that the many talks are not coordinated and may not provide complete coverage of all important topics. Covering the same material as found in the Power Measurements program can take several years of attendance at a meter school. The Power Measurements' course provides complete coverage of all subject matter in one effective session.

Is training at your facility the most cost effective approach?

Sending an employee to a meter school involves significant expense. Registration fees can be $300 to $500 per student. Travel and lodging can easily add another $1000 per student. Power Measurement training courses provide training to up to 25 people for less that the cost of sending just a few people to a meter school.

For additional information call or email at the address below.

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Power Measurements
Metering Training Outline

Power Measurements offers a complete metering training curriculum. Optimize your training dollars while according your staff the best training available. This extensive offering provides a complete metering education for everyone from novice to experienced engineer. The course can be customized for your exact training needs.

- **Basic Knowledge**
  - **History of Electricity**
  - **DC Circuit Theory**
    - Voltage
    - Current
    - Resistance
    - Capacitance
    - Inductance
    - Ohm's Law
    - Kirchoff's Voltage Law
    - Kirchoff's Current Law
    - Power
  - **AC Circuit Theory**
    - Sinusoidal Waveforms
      - Value
      - Frequency
      - Phase
    - AC – DC Equivalence
      - Circuit Laws must Hold
      - Linear Loads
        - Resistive Loads
        - Capacitive loads
        - Inductive Loads
        - Complex Loads
    - Power (Sinusoidal)
      - Power Triangle
        - Active Power
        - Reactive Power
        - Apparent Power
      - Power Factor
  - **Power Measurement in the Digital World**
    - Complex Waveforms
      - Harmonics
        - Representation
        - Sources
        - Example Waveforms
      - Time Variant
        - Examples
    - Time Domain Definitions
      - Power
      - VA
      - VAR
    - Frequency Domain Definitions
      - Power
      - VA
      - VAR
      - Limitations
    - Application to the Real World
      - Harmonic Loads
      - time Varying Loads
  - **Three Phase Theory**
    - Polyphase Waveform Definitions
      - Vector Diagrams
        - Definitions
        - How we use them
      - US Service Types
        - Single Phase
        - Three Wire Delta
          - Deriving the vector diagram
        - Four Wire Delta
          - Deriving the vector diagram
        - Three Wire Wye
    - Polyphase Power Computation
  - **Instrument Transformers**
    - Transformer Theory
    - Current Transformers
      - CT Safety Considerations
      - Understanding CT Specifications
        - Nameplate Ratio
        - Accuracy Class
        - Burden Class
        - Rating Factor
      - High Accuracy & Extended Range
      - High Voltage Applications
  - **Potential Transformers**
    - Understanding PT Specifications
      - Nameplate Ratio
      - Accuracy Class
      - Burden Class
- **Practical Application**
  - **How Meters Work**
    - Electromechanical
    - Electronic
  - **Meter Forms & Sockets**
  - **Current Transformers**
    - Getting the best performance at lowest cost
  - **Potential Transformers**
    - Considerations in using low ratio transformers for 480V services
  - **Metering Applications**
    - Single phase services
    - 3-Wire Delta Services
    - 4-Wire Delta Services
    - 4-Wire Wye Services
  - **Non-Blondel Metering Errors**
    - 3-Wire Single Phase (2S, 4S)
    - 4-Wire Delta (5S & 8S Families)
    - 4-Wire Wye (5S and 6S Families)
  - **Demand Metering**
    - What is Demand Metering
    - Fixed vs Rolling
  - **Time of Use Metering**
  - **Four Quadrant Metering**
    - Delivered vs Received

- **Field Testing**
  - **Testing Site Configuration**
    - Error Sources
    - Error Estimates
  - **Testing Current Transformers**
    - Ratio Testing
    - Burden Only Testing
    - Admittance Testing
    - Direct Burden Measurement
  - **Testing Potential Transformers**
    - Low ratio (Primary V < 600V)
  - **Field Testing Meters**
    - Using Test Set Voltage and Current
    - Using Site Voltage with Generated Current
    - Using Site Voltage and Current
- **Advanced Topics**
  - **ANSI C12**
    - Introduction to ANSI C12
    - Changes on the Way
    - New: C12.29 Field Testing Standard

Pricing: Two day course $3000 plus transportation cost to venue. There is also a materials fee of $50 per student which includes a copy of the ***Power Measurement Handbook*** and a full color bound volume of all Power Point slides from the classes. Cost example: Class for 20 students in Charlotte, NC ($3000 + $1000 + ~ $500 transportation) Recommended maximum class size is 25.

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