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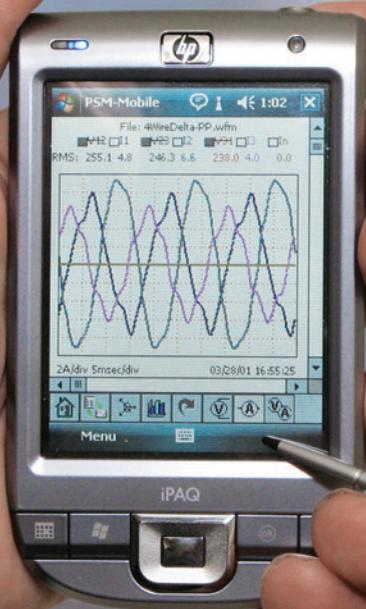
# Electrical Products & Solutions™

The Purchasing Guide for Electrical Contractors

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## ELECTRICAL TESTING AND NFPA 70E:

*METERS WITH BLUETOOTH  
AND CAT IV RATING  
ARE SAFEST*



**MEGGER:**  
A GUIDE TO  
TRANSFORMER  
WINDING  
RESISTANCE  
MEASUREMENTS

**SOLARWORLD:**  
A RAY OF  
SUNSHINE  
IN A  
GLOOMY  
ECONOMY

# ELECTRICAL TESTING AND NFPA 70E:

## Meters with Bluetooth and Cat IV Rating are Safest

By Michael Daish

### Introduction

The choice of a test meter, power monitor or datalogger for a power study must now take into account the safety standards currently in force to protect electrical workers under National Fire and Protection Association (NFPA) 70E standards. When selecting electrical testing tools users are confronted with the following considerations:

1. Does the meter meet existing safety standards?
2. Does the meter meet both my company or organization's safety and measurement goals?
3. Does the meter improve worker safety?

We assert that a CAT IV safety rating and Bluetooth wireless communication are attractive and practical features that are compatible with NFPA 70E safety programs and procedures. In this article we discuss how these design features of the latest power testing meters enhance worker safety and provide an overall better "user experience".

### The Impact of NFPA 70E on Electrical Testing and Meter Design

Safety in the electrical testing industry has taken on a new level of importance with the focus on Arc Flash hazards that is embodied in the NFPA 70E Standard for Electrical Workplace Safety. NFPA 70E covers the range of electrical safety issues such as work practices for maintenance, installation and repair activities. It is intended to be followed by employers, employees, engineers, electricians, their supervisors, and new hires such as apprentices. OSHA (Occupational Safety & Health Administration) bases its electrical safety mandates on the NFPA 70E standard. It provides guidance on employee training, how to implement an effective electrical safety program, work

planning and procedures such as lockout/tagout rules. It specifically prescribes the use of PPE (Personal Protective Equipment) such as gloves, visors and fire-retardant clothing. Meters and test equipment are also classified as PPE.

To comply with NFPA 70E owners of electrical equipment and systems must display warning labels on equipment that elec-

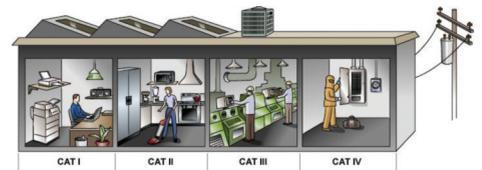
trical workers maintain, inspect or repair. The labels shall indicate the level of Arc Flash hazard (see example) and the recommended PPE when working on the equipment. Those involved in electrical testing and the employment of electrical workers must implement safety programs and procedures that follow NFPA 70E. If there is non-compliance and an accident occurs there is legal liability that can result in citations, work shutdown, fines or other sanctions. It is generally recommended that electrical testing and maintenance workers use tools with the latest highest safety rating (CAT IV) to be compatible with their safety practices. Without this rating, the worker could be injured if a sudden transient overvoltage occurs and the tool creates an arcing flash-over. The four CAT environments and their maximum transient overvoltages that testing tools must withstand are depicted below (as per IEC/EN 61010-1 for phase to ground)

Overvoltage Protection Categories	Overvoltage Withstand Capability
CAT II 600V	4000V
CAT III 300V	
CAT III 600V	6000V
CAT IV 300V	
CAT III 1000V	8000V
CAT IV 600V	
CAT IV 1000V	12000V

Most older test meters are designed to sustain transient overvoltages in CAT III.

Higher-rated CAT IV tools have improved protection circuitry. CAT IV 600V instruments are a better choice and are suitable for all CAT test environments at 600V or below.

- **CAT (Category) IV** refers to power lines at the utility connection, the origin of installation or service entrance. It includes outdoor overhead and underground cable runs that could be affected by lightning, utility meter locations and primary breakers or fuses.
- **CAT III** deals with



WARNING

**Arc Flash and Shock Hazard**

**Appropriate PPE Required**

24 inch Flash Hazard Boundary  
3 cal/cm² Flash Hazard at 18 inches  
10F PPE Level, 1 Layer 6 oz Nomex II, Leather Gloves, Faceshield

480 VAC Shock Hazard when Cover is removed  
36 inch Limited Approach  
12 inch Restricted Approach - 500 V Class 00 Gloves  
1 inch Prohibited Approach - 500 V Class 00 Gloves

EQUIPMENT NAME: WELL PUMP A-70C STARTER

distribution level wiring, 480-volt and 600-volt circuits such as 3-phase bus and feeder circuits, motor control centers, load centers and distribution panels. Also included in CAT III are switchgear, motors, transformers and similar fixed loads, and loads that can generate their own transients.

- **CAT II** covers outlet receptacles and their plug-in loads such as appliances and portable tools.
- **CAT I** refers to electronic equipment and circuits.

### Personal Protective Equipment and Meter Operation and Design

Consider that under NFPA 70E it is now mandatory to wear personal protective equipment (PPE) when installing test equipment. The following table shows some examples:

#### Protective Clothing and Personal Protective Equipment (PPE) As Defined in NFPA 70E-2004

Flash Hazard Category 0	Flash Hazard Category 2	Flash Hazard Category 4
Cotton underwear	Cotton underwear and T-shirt (short-sleeve)	Cotton underwear and T-shirt (short-sleeve)
Long sleeve cotton shirt & pants	FR shirt & pants (or FR coverall)	FR shirt & pants (or FR coverall)
Safety glasses or goggles	Hard hat	Hard hat
	Safety glasses or goggles	Safety glasses or goggles
	Arc-rated face shield	Hearing protection
	Hearing protection	Leather gloves and shoes
	Leather gloves and shoes	Voltage rated gloves and tools
	Voltage rated gloves and tools	Multilayer flash suit and flash suit hood (> 40 cal/cm <sup>2</sup> )



Meter design and operation must now take the NFPA safety requirements into consideration and make meter operation easier while wearing PPE. In the following pictures we see a worker wearing a PPE level 1 Nomex® fire-retardant overall, gloves, and a visor. The next picture shows a level PPE 4 suit, sometimes referred to as a “Homer Simpson” suit. It is claustrophobic and uncomfortable to wear even for a few minutes. It substantially restricts movement, and the handling and operation of tools, meters and instruments. One can see that it would

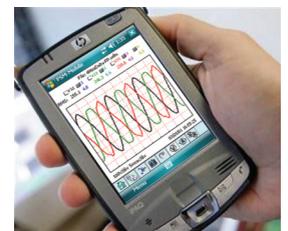


be difficult to program any meter while wearing such cumbersome PPE. With either level of PPE the hood or visor impairs clear vision of a meter display and keypad legends. The “thick-fingered” leather gloves eliminate the tactile feel necessary for locating and operation of buttons on a keypad. There is a safer and better way.

Bluetooth communications elegantly solves the problem of safely operating a meter since Bluetooth wireless communications allows you to operate the meter remotely from a PC or PDA, well away from high voltages. A power study involves connecting probes to the power conductors to sense voltage and current, and these connections must be made while wearing the mandatory PPE. After installing the probes the user can retreat several feet to a safe zone, take off the visor and gloves and

comfortably view waveforms, phasors and power meters from a PC or PDA to check connections and initiate a monitoring session remotely using Bluetooth.

Remote operation of a testing meter is ultimately the safest practice. The new PowerSight meters are ideal for NFPA 70E safety programs. The PowerSight model PS2500 Power Logger, PS3500 Energy Analyzer and PS4500 Power Quality Analyzer all combine the safety benefits of Bluetooth communications and CAT IV rating while also meeting the measurement requirements for energy studies, harmonics and power quality investigations. They also have removable SD memory card slots for storing measurement data, logs and disturbance events. This data can be transferred to a PC either wirelessly by Bluetooth or by the memory card.



### Safely Leaving the Meter Behind to Monitor

Most power studies are performed indoors and require leaving the meter unattended for days or weeks. The user is confronted with the problem of how to install the monitor safely and unobtrusively. We do not want the meter to (Continued on page 12)

be tampered with for safety reasons or risk losing or corrupting captured data. The compact size (3.89" x 7.72" x 1.58") and low weight (1.1 lbs) of the PowerSight meter means that it can be easily installed in voids and hidden away in electrical switchgear, panels and similar



locations where electrical studies are performed. The picture showing a PowerSight meter monitoring a panel highlights how the meter's compact size and low weight has advantages. In this situation the meter is suspended high-up in a soft case by a strap around conduit. The me-

ter is well out-of-the-way; it is a safe installation and is far less susceptible to being tampered with.

### **Conclusion**

Safety standards and procedures must be adhered to when using meters for energy audits, power quality studies, or simple data logging. The latest revision of NFPA 70E specifies the appropriate PPE (such as clothes, face-shields, and gloves) according to the flash hazard severity at specified voltage and energy levels. Personal protective equipment (PPE) involves wearing cumbersome suits, thick gloves, hoods or visors which interfere with the worker's freedom of movement, vision and dexterous control of tools. The design and operation of electrical testing tools such as meters, power monitors and dataloggers must take both the safety regulations and the worker's operational circumstances into consideration.

With respect to the design of a meter, it must withstand transient overvoltages in order to protect the user. The CAT ratings described above specify the level of withstand voltage for different nominal supply voltages. A CAT IV 600V/8000V rated tool means that it is suitable for use in all locations on conductors that have up to 600V phase to ground and can withstand an 8000 volt transient overvoltage event. The PowerSight models PS2500, PS3500 and PS4500 are CAT IV 600V/8000V rated.

Bluetooth wireless communication is an excellent solution that provides the best safety experience. Bluetooth remote operation allows the user to remove the visor and gloves and safely operate the meter at a distance up to 20 feet away using a PC or PDA. This approach actually provides a better user experience since the user can take advantage of the size and higher resolution of a PC display. With the PowerSight Manager software the user can view waveforms more clearly, take waveform snapshots and save data on the PC. After data is downloaded the user can expand graphs for detail, export the data to Excel and generate professional-looking final reports as Word or pdf documents. □

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#### *About the author*

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