

Engineer's Notebook

International Safety Standards for Digital Multimeters

New International Safety Standards for Digital Multimeters

The increased occurrence and levels of transient overvoltages in today's power systems have given rise to more stringent safety standards for electrical measurement equipment. Transients that ride on top of power sources (mains, feeder or branch circuits) can trigger a sequence of events that may lead to serious injury. Test equipment must be designed to protect people working in this high-voltage, high-current environment.

Who Develops Safety Standards?

The IEC (International Electrotechnical Commission) develops international general standards for safety of electrical equipment for measurement, control and laboratory use. In 1988, IEC replaced an older standard, IEC-348, with a more stringent standard, IEC-1010-1. IEC-1010-1 is used as the basis for the following national standards:

- US ANSI/ISA-S82.01-94
- Canada CAN C22.2 No.1010.1-92
- Europe EN61010-1:1993

What's Different About IEC-1010-1 Compared to IEC 348?

IEC-1010-1 specifies categories of overvoltage based on the distance from the power source (see Fig. 1) and the natural damping of transient energy that occurs in an electrical distribution system. Higher categories are closer to the power source and require more protection.

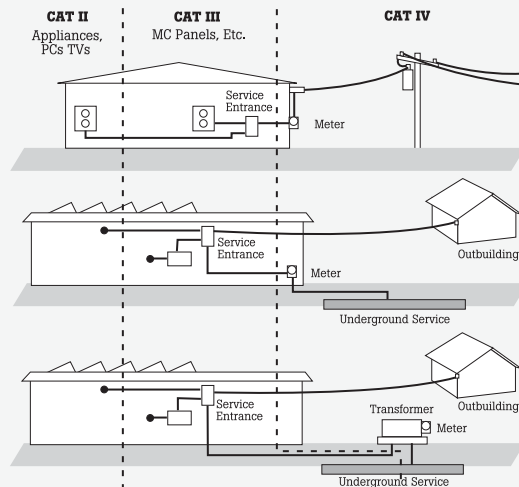
- **Category IV**, called the primary supply level, refers to the overhead or underground utility service to an installation and is presently beyond the scope of IEC-1010-1.
- **Category III**, called the distribution level, refers to mains voltage feeder or branch circuits. CAT III circuits are typically separate from the utility service by at least a single level of transformer isolation. The equipment consists of fixed installations. Most of Transcat's customers are measuring at the Category III level.
- **Category II**, refers to the local level, to appliances, portable equipment, etc.
- **Category I**, refers to the signal level, to telecommunication, electronic equipment, etc. Categories I to IV are overvoltage installation categories; they are defined by the location of the equipment to be tested. Within each installation category there are voltage classifications. It is the combination of installation category and voltage classification which determines the maximum transient withstand capability of the instrument.

Instruments are Tested as Follows:

CAT II	600V	4000V peak impulse transient	12 Ohm source
CAT II	1000V	6000V peak impulse transient	12 Ohm source
CAT III	600V	6000V peak impulse transient	2 Ohm source
CAT III	1000V	8000V peak impulse transient	2 Ohm source
CAT IV	600V	8000V peak impulse transient	<1 Ohm source
CAT IV	1000V	12000V peak impulse transient	<1 Ohm source

What Changes Are Required in Instrument Design to Meet IEC-1010-1 Standards?

One of the main differences concerns spacing requirements inside the instrument. Spacing is referred to in terms of "creepage" distance (along surfaces) and "clearance" distance (through the air). IEC-1010-1 increases the spacing requirements for a given maximum overvoltage. Larger clearance distances enable the meter to withstand higher overvoltage transients.



- CAT II**
 - Outlets and long branch circuits
 - All outlets at more than 10m (30 ft.) from Category III
 - All outlets at more than 20m (60 ft.) from Category IV
- CAT III**
 - Feeders and short branch circuits
 - Distribution panel devices
 - Heavy appliance outlets with "short" connections to service entrance
 - Lighting systems in large buildings
- CAT IV**
 - Outside and service entrance
 - Service drop from pole to building
 - Run between meter and panel
 - Overhead line to detached building
 - Underground line to well pump

Demarcation between Location Categories III and IV is arbitrarily taken to be at the meter or at the main disconnect [ANSI/NFPA 70-1990 [2], Article 230-70] for low-voltage service, or at the secondary of the service transformer if the service is provided to the user at a higher voltage.

For more information, see ISA-S582.01-1994, Annex J Source: ANSI/IEEE C62.41-1991

ANSI/ISA S82.01-1994

What Does It Mean to Be UL-Listed, CSA-Certified, TUV or VDE-Certified?

Underwriters Laboratories (UL), Canadian Standards Association (CSA), TUV and VDE (German standards organizations) are approval/listing agencies. They are independent testing laboratories that test products against national/international standards or their own standards which are based on national/international standards. UL3111, for example, is based on IEC-1010-1. UL1244 is based on the older IEC-348 standard. To be UL-listed, CSA-certified or TUV or VDE-certified, the manufacturer must employ the services of the approval/ listing agency to actually test the product's conformity to the agency's standard. This can be a lengthy and costly process. Only upon successful completion of this independent testing by the listing agency may the manufacturer display the mark of the agency on the product.

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