

What are Measurement Categories (CAT I, CAT II, etc...)?

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Overview

Electrical test & measurement tools will be assigned to 4 different designations from I - IV. These categories can be confusing; therefore, National Instruments has developed this tutorial to help customers understand what these categories mean. Tools that interact with electricity are designed for specific applications and conditions. Exceeding or deviating from application parameter can lead to inaccurate measurements or injury. With that said, let's take a closer look at the four primary measurement categories for electrical tools.

Measurement categories can be broken down into several categories: CATI, CATII, CATIII, and CAT IV.

Measurement Category I:

This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Measurement Category II:

This category refers to local-level electrical distribution, such as that provided by a standard wall outlet or plug in loads (for example, 115 AC voltage for U.S. or 200 AC voltage for Europe). Examples of Measurement Category II are measurements performed on household appliances, portable tools, and similar modules.

Measurement Category III:

This category refers to measurements on hard-wired equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus bars, junction boxes, switches, socket outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.

Measurement Category IV:

This category refers to origin of installation or utility level measurements on primary over-current protection devices and on ripple control units.

Measurement Categories are used to rate test instruments on their ability to resist a voltage spike, which is applied through a specific resistance. The higher the category, the more risk there that a high voltage can overload a circuit and cause electrical and physical damage. Usually, the higher the CAT (category) rating, the safer the rating.

Let's go over an example, Measurement Categories are used in the maximum switching voltage rating in the specifications for National Instruments switches. The PXI-2584 specifications are:

Maximum switching voltage

Channel-to-ground.....300 V Category II, 600VDC, V ACpk Category I.

Using the chart below we deduce the following: This specification informs the user this module is rated for 300V CAT II and 600V CAT I. In other words, this module can withstand up to 2,500V impulse voltage. This specification additionally informs the user this module must not be connected to MAINs CAT II circuits when operated above 300V. Lastly, the user should not use this module with Category III or IV circuits.

Rated Voltage	IEC 61010-1 2nd Edition			UL 61010B-1 (UL 31111-1)		
	CAT IV	CAT III	CAT II	CAT III	CAT II	CAT I
150V	4,000V	2,500V	1,500V	2,500V	1,500V	800V
300V	6,000V	4,000V	2,500V	4,000V	2,500V	1,500V
600V	8,000V	6,000V	4,000V	6,000V	4,000V	2,500V
1,000V	12,000V	8,000V	6,000V	8,000V	6,000V	4,000V
Resistance	2 ohms	2 ohms	12 ohms	2 ohms	12 ohms	30 ohms