Gantner instruments

The right measurement lead for HV-modules

The right
measurement lead
for HV-modules

Gantner instruments

Contents

Author:
Schruns, Austria, August 2025

Test leads for Gantner Instruments „A12X“ & „A12X Plus“ modules

Gantner Instruments ensures that all high voltage modules are tested in accordance with the EN IEC 61010-2-030 standard. This standard specifies not only the requirements for the modules themselves, but also for the corresponding measurement accessories and their use in the individual measurement categories.

Measurement categories and their meaning

The measurement categories CAT I to IV are used to classify electrical measuring instruments. The EN IEC 61010-2-030 standard specifies how these measurement categories are defined and what safety requirements apply. They specify the environmental conditions and conditions under which a measuring instrument can be used safely. Furthermore, clearance and creepage distances are defined for the measurement categories CAT II to CAT IV.

What are the 4 measurement categories?

- **CAT 0 / CAT I (Category 0/I):** This category covers measurements on circuits that do not have a direct connection to the mains e.g. battery operated devices or devices of protection class 3 (operation with protective extra-low voltage).
- **CAT II (Category II):** This category concerns measurements on equipment connected to a power outlet, such as household appliances and electronic equipment in offices. Here there is a higher risk of electric shock than in CAT I.
- **CAT III (Category III):** This category relates to measurements in the distribution of low-voltage equipment, such as in switchboards, sockets and wiring in houses or buildings. The risk of electric shock is higher here than in the previous categories.
- **CAT IV (Category IV):** This category concerns measurements at the main power supply, e.g. at the meter or at the mains connection. Here there is the highest risk of electric shock.

It is essential to select the correct measurement equipment according to the specific measurement category. This minimizes the risk to equipment and the user.

Gantner Instruments GmbH
Montafonerstr. 4 · A-6780 Schruns · Tel. +43 (0) 5556 · 77463-0
info@gantner-instruments.com
www.gantner-instruments.com

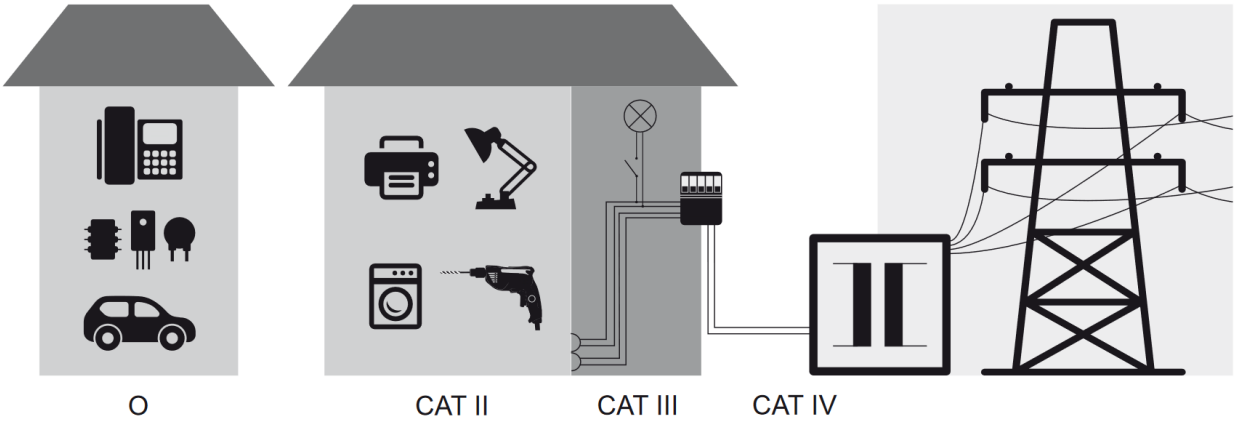

Figure 1: categorization CAT I to IV (source:Stäubli)

Which criteria must measuring leads comply with?

Test leads used with Gantner Instruments high voltage modules must be tested and approved according to the EN IEC 61010-2-030 standard. Older editions of the standard were very incomplete with regard to connections for measuring circuits and were sometimes incorrectly designed. This has been responded to in the latest edition (November 2022) and the requirements for 4mm „banana plug" connections have been addressed in more detail.
Air gaps and crank gaps have been defined, as well as the necessary requirements for solid insulation that allow the use of 4mm test accessories up to 1500VDC without CAT.

In addition, requirements for material composition, environmental conditions, construction, etc. are defined, which must be met by the test accessories. For example, retractable insulating sleeves are not considered as sufficient protection!

Air gap, creepage distances and solid insulation

- The **air gap** is defined as the shortest distance between two conductive parts.
- The **creepage distance** is the shortest connection between two conductive parts along the surface of a solid insulating material.
- The **solid insulation** must withstand the electrical and mechanical stresses for the intended operation. Evidence of electrical stress provided by specified test voltages.

Gantner Instruments GmbH
Montafonerstr. 4 · A-6780 Schruns · Tel. +43 (0) 5556 · 77463-0
info@gantner-instruments.com
www.gantner-instruments.com

What requirements must now be met by the 4mm „banana“ connection?

Conductive parts of unoccupied terminals of measuring circuits that can accept dangerously active voltages of up to 1000 V AC or 1500 V DC must comply with clearances and creepage distances as specified in Table 1.

Voltage at conductive parts of the connection	Air gap and creepage distance
Effective value of AC voltage or DC voltage V	 mm
≥ 30 ≤ 300	0,8
> 300 ≤ 600	1,0
> 600 ≤ 1000	2,6
> 1000 ≤ 1500 [a]	2,8
[a] DC voltage only	

Table 1: clearance and creepage distances for connections of measuring circuits up to 1000 V AC and 1500 V DC

Measuring circuits of measuring category II to IV have higher requirements for clearances and creepage distances due to the existing risk. Table 2 contains the necessary clearances of basic insulation which are required for measuring circuits of measuring category II, III and IV.

Air gap for basic insulation			
AC voltage or DC voltage	Measurement category II mm	Measurement category III mm	Measurement category IV mm
> 150 ≤ 300	1,5	3,0	5,5
> 300 ≤ 600	3,0	5,5	8,0
> 600 ≤ 1000	5,5	8,0	14
> 1000 ≤ 1500 [a]	8,0	11	18
[a] DC voltage only			

Table 2: clearance and creepage distances for measurement category II, III and IV in measurment circuits

Gantner Instruments GmbH
Montafonerstr. 4 · A-6780 Schruns · Tel. +43 (0) 5556 · 77463-0
info@gantner-instruments.com
www.gantner-instruments.com

Accordingly, for 1500V DC, the standard requires a minimum clearance and creepage distance of 2.8 mm for dimensions E and H from Figure 2.
Compliance with the air gap and consequently also the creepage distance is already sufficiently fulfilled by the requirement for the construction insulation of measurement category II with 5.5 mm.

For the solid insulation, EN IEC 61010-2-030 requires two tests with defined voltages. An AC voltage test with a duration of at least 5 s to test transient overvoltages and an AC voltage test with a duration of at least 1 min to test the long-term effects of the solid insulation.
The required test voltages are greater for measurement category III circuits than for 1500VDC circuits without measurement category.

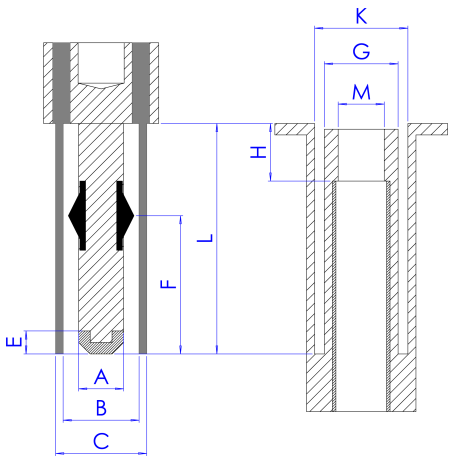

Figure 2: bananaplug

Recommendation by Gantner Instruments

Striving for the maximum safety, Gantner Instruments recommends test leads specified to Din EN IEC 61010-2-030 with 1000 VDC CAT III without tower construction (non-stackable).
These test leads can be found from Stäubli or other reputable manufacturers. Stäubli has specifically released an information sheet specifying products suitable for 1500 VDC.
We are convinced that these high quality test leads will meet your requirements and provide you with optimum safety in your projects.

Gantner Instruments GmbH
Montafonerstr. 4 · A-6780 Schruns · Tel. +43 (0) 5556 · 77463-0
info@gantner-instruments.com
www.gantner-instruments.com

High voltage warning

Caution high voltage module - danger to life and health if used improperly.

- Modules may only be put into operation by personnel trained for this purpose.
- All metal housing parts must be securely and permanently connected to the protective earth conductor (PE).
- Only plugs and cables with contact protection may be used. Components require an approved voltage of 1500 VDC.
- During installation, the complete system must be de-energized and safely disconnected from the mains.
- All relevant safety rules must be observed.
- Permissible measuring systems: DC voltage up to 1500 V, sinusoidal AC voltage (< 30 kHz) up to 1000 V.
- Do not operate with damaged sheath.
- The measurement signal must be limited to a maximum overvoltage of 6 kV to limit transient overvoltages.

Gantner Instruments GmbH
Montafonerstr. 4 · A-6780 Schruns · Tel. +43 (0) 5556 · 77463-0
info@gantner-instruments.com
www.gantner-instruments.com

Gantner instruments

Gantner Instruments GmbH

Austria | Germany | France | Sweden |
India | USA | China | Singapore

Headquarter

Montafonerstraße 4
6780 Schruns
Austria

Tel. +43 5556-77463-0
office@gantner-instruments.com

www.gantner-instruments.com

Test and Measurement Technology.
Designed for You.