High Value Precision Resistors for Multimeter and Insulation Test Equipment Calibration Verification Up to 4000V

ITTSB Blog

Using high value, precision thick film resistance elements, I have succeeded to make a calibration standard level verification box for evaluation of latest produced insulation testers.

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Company/Institute: ITTSB Blog www.ittsb.eu

Industry/Application Area: Electrical test and measurement equipment

Product used: Powertron GST 4020

The Challenge

Handheld insulation test equipment currently on the market produce an output of several test voltages and several measuring ranges. Below are common examples:

- 50V: 3M to 55M
- 100V: 3M to 110M
- 250V: 3M to 275M
- 500V: 3M to 550M
- 1000V: 3M to 25.0 G Ohm

Verification of the insulation test equipment requires a specialized and complex high-resistance system that includes several resistance values. At a minimum one resistor only is to act as representative example for its measuring range. Additional requirement for such special high-resistance system this is max working voltage that must be able to cover 1000V nominal, up to a maximum of 4000V.

The Solution

The product specifications of the Powertron Thick Film GST 4020 Series resistors meet the application requirements of resistance value and working voltage. This outstanding product has even more to give: Precision level of 0.25% up to 2.6 G Ω and a remarkable TCR specification.

The User Explains

As a professional electrician, I am aware that the voltage setting of insulation test equipment must be adjusted to double the working voltage of the circuit to be tested. Some electrical applications require test voltages of higher than 1000V, and other unique applications can require 2000V. A good example of a high voltage scenario is a ventilation system used in the mining industry. This presents a very rare challenging case to find suitable insulation resistance test equipment.

As a blogger, I review electrical test and measurement equipment. Among the Blog's main activity is verification of product specifications. In 2016 test and measurement industry started to release insulation testers with claims of test voltages up to 4000V, therefore increasing the need for testing systems for such voltage requirements. In order for ITTSB Blog to be able to conduct a fair and thorough evaluation, since 2017 and future years, new verification equipment was needed to conduct testing in accordance to latest produced insulation testers specifications.

The solution was to design a test verification box that includes internal reference precision resistors. The selection of the resistors was a very thorough exercise. Not just any random resistor off the shelf would work for this application. Resistance values chosen were of 1M, 10M, 39M, 50M, 100M, 200M, 2.6G and 16G. By connecting the resistor elements in series, I was able to expand the number of measurement points. This provided flexibility to test across multiple applications and I was able to evaluate each specific test requirement.

Fig 1: Kelvin test leads attached to GST 4020 on clean and non-conductive surface

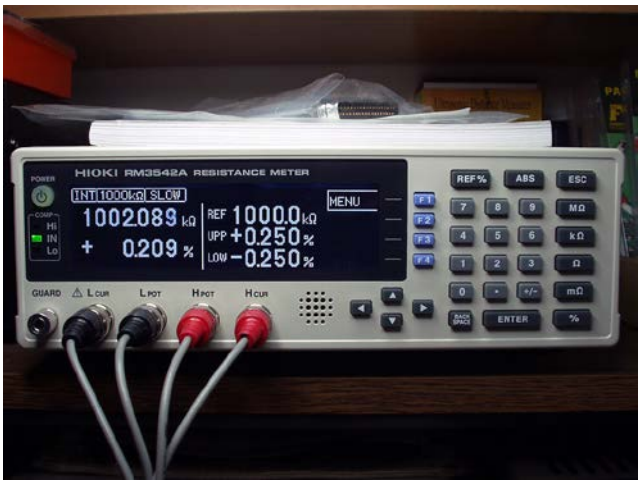


Fig 2: High precision resistance meter showing 100% resistor accuracy measurement results

While still remaining a self-made verification installation, it's independently up against very special and demanding requirements for high accuracy paired with high resistance values – something that only can get achieved by use of very special components.

The selection of the Powertron GST 4020 resistance elements with 0.25% tolerance allowed the verification box to achieve the level of a true metrology standard– and competes with insulation testers that feature four digits of measurement resolution at a peak 10% tolerance at 25.0 GΩ.

While being a self-made verification box, its performance measures up against very specialized and demanding requirements for highly accurate paired resistance values – something that was previously only achieved by the use of very special components. To evaluate the verification box, I compared its performance with that of an industry leading resistance measurement equipment. The HIOKI RM3542A precision resistance meter was used as a reference. This is a meter with seven digits display resolution also equipped with a special comparator function that can measure even a single resistor tolerance in percentage at highest precision up to 100M Ohm (128M max measuring capacity). The HIOKI RM3542A precision resistance did verify tolerance specifications' as Powertron products label. For higher resistance elements of 200M, 2.6G & 16G Ohm good operation was confirmed by the use of BM878 insulation tester a product of BRYMEN Technology Corporation in Taiwan.

In conclusion, by having the ultimate in quality, Powertron resistors at my hands, as well as the high-precision HIOKI RM3542A, I am now able to fully understand why both brands, Powertron and Hioki, feel proud and enthusiastic about their work and products.
It is clear to see why Powertron is a leader in their business sector. As a customer of both Powerton and Hioki, I am totally satisfied.

- Communication with Powertron, a brand of VPG Foil Resistors, and the delivery to Greece was excellent.
- All ordered resistance values were spot on compared to the requested specifications. All products arrived promptly with escorted documentation (certificate of compliance) and safely packaged.

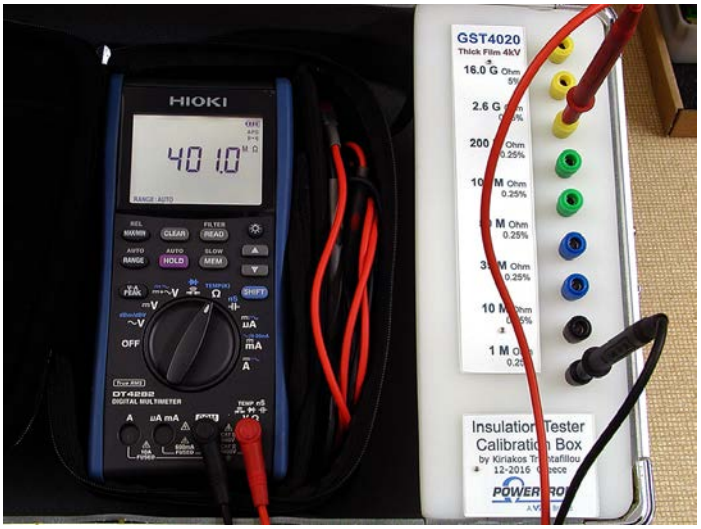


*Fig **3**: the final calibration tester setup – resistance values are: 1MΩ, 10MΩ, 39MΩ, 50MΩ, 100MΩ, 200MΩ, 2.6GΩ, 16.0G*

“All ordered resistors are spot-on in regards of all requested specifications”

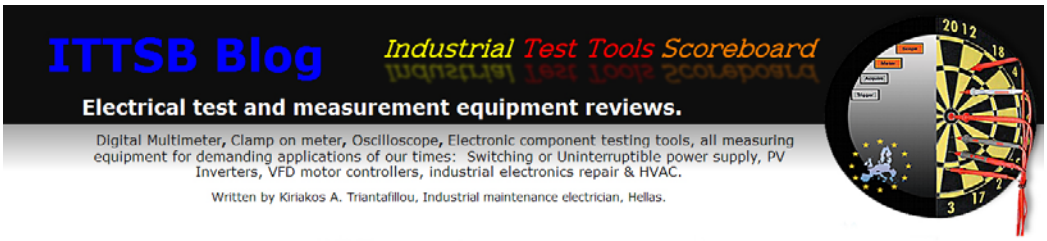
Acknowledgement:

ITTSB Blog was founded in June 2012. Since then, all Blog content was related to electrical test and measurement equipment and tools. In recent years, the Blog has expanded to new sectors including complex Oscilloscopes. In 2017, the Blog will expand into power quality measurement and calibration tools.

I am a second generation electrician and have been in the business for 32 years since the age of fifteen years old. I am well versed in electrical and electronics applications.

The ITTSB Blog is a totally independent voice. It is diplomatic in its points of view and maintains its purpose of offering sincere information.

At www.ittsb.eu you will find complete presentation and how to of verification box for Insulation Testers.



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