A dedicated resistance meter?

Here is when it makes sense ...

Measuring DC resistances is one of the functions pretty much every bench multimeter provides. Then why you would you need a separate resistance meter?

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One of the best digital multimeters available on the market offers a lowest resistance range of 1 Ohm. That is great and more than sufficient when developing circuits or testing PCBs. However, when measuring the electrical resistance of conductive materials or welding contacts, you are looking at values which are more in the mOhm or µOhm range.

That's why the "smallest" bench resistance meter from HIOKI - the **RM3544** - has a lowest resistance range of 30 mOhm. Its "bigger brother", the **RM3545**, has a lowest resistance range of 10 mOhm and a resolution of just 0.01 µOhm.

Figure 1: HIOKI RM3545 Resistance Meter

Another aspect is measurement time: Multimeters are not necessarily optimized to perform measurements at high speed. HIOKI's resistance meters, on the other hand, have been designed to also perform resistance measurements in mass production environments where speed is an important factor. For example, when a module of lithium ion batteries is produced then typically the quality of every spot weld connection to the busbar is tested by measuring the contact resistance. The **RM3545** can perform such a measurement in its smallest 10 mOhm resistance range in just 41 ms (fast mode). In higher resistance ranges the measurement time is as low as 2.2 ms.

A very useful function - which is hard to find even in top of the range multimeters - is a contact check function: If activated, a measurement is only started after ensuring that the probe has proper contact to the device under test. This is a feature surely not critical in a lab environment, but really useful in production environments where it helps to avoid rejects caused by poor contact of the probe to the DUT. N.B.: The contact check function is featured in the **RM3545**, but neither in the **RM3544** nor the **RM3544-01**.

Figure 2: Backside of RM3545-02 (including two Z3003 multiplexer cards)

Coming back to the example with the busbar welds of the battery module: The longest time in a test process is needed for mechanically moving the DUT to the test probe or test fixture. Once positioned, you want to perform as many tests as possible before having to mechanically move the DUT again. This is where multiplexers come into play. Especially when the number of tests to be performed is high, dedicated multiplexers like HIOKI's **SW1002** provide the required number of measurement channels. If the number of channels is 20 or less, then such a dedicated multiplexer unit isn't required. In this case the **RM3545-02** offers two slots on the backside that can each hold a multiplexer card **Z3003**. Each of these multiplexer cards offers 10 measurement channels for 4-wire measurements and they can easily be added to the **RM3545-02** models. N.B.: You can only add multiplexer cards to the **RM3545-02** model, but not to any other version of the **RM3545** as those others don't have the slots required to add the cards.

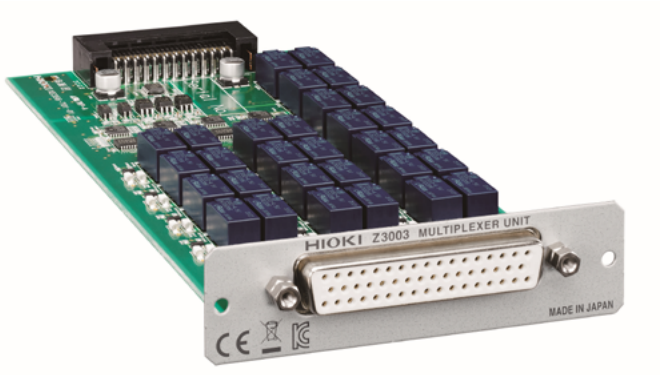

Figure 3: Z3003 multiplexer card

4-wire measurements usually mean 4 connectors at the measurement instrument for the test lead. However, if you look closely at the **RM3544** or **RM3545** then you will see 5 connectors instead of 4. The 5th connector is the so called "guard terminal", which is designed to reduce measurement noise that can become relevant especially when test currents are small, i.e. in the high resistance ranges.

Technically the guard terminal allows to "ground the shield" of the test lead. The guard terminal is supported in HIOKI's test leads **L2101**, **L2102**, **L2103** and **L2104**. Of course you can also use test leads with the **RM3544** and **RM3545** that don't connect to the guard terminal, such as HIOKI's test leads **L2100** or **L2107**. Especially when you intend to measure small resistances then the test currents are high and the impact of noise is low. But again, especially in the MOhm resistance ranges not using the guard terminal can impact the measurement results.

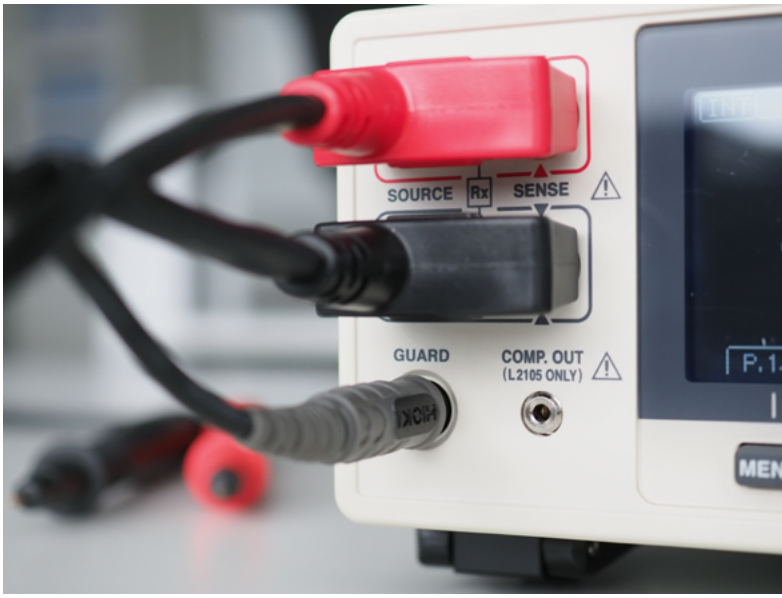

Figure 4: Guard terminal: More stable measurements in high resistance ranges

The temperature sensor **Z2001** is not just a nice add-on that allows you to also read the temperature when making a resistance

measurement. Instead it allows to correct the measured resistance value by taking into account a user-specific resistance temperature coefficient. This is especially useful when measurements can't be performed in a temperature controlled environment. The **Z2001** temperature sensor is an included accessory of the **RM3545** models and an option for the **RM3544**.

Another really useful accessory is the LED Comparator Attachment **L2105:** It indicates judgment results with green and red LEDs, eliminating the need to look at the instrument's screen. Since the lamps do not light up when the measurement leads are open, this little optional accessory can also be used to ensure a proper connection to the DUT.

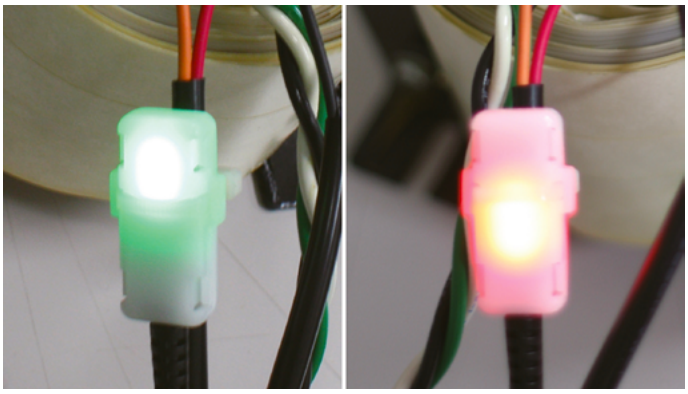

Figure 5: L2105 LED comparator attachment

And finally, should you have an application which does require a measurement instrument with a low resistance range but at the same time doesn't allow you to use a bench resistance meter, then **HIOKI's RM3548** might be the solution: It is portable, yet still features a smallest resolution of just 1 µOhm and offers a smallest measurement range of only 3 mOhm.

Figure 6: The portable resistance meter RM3548 from HIOKI

The **RM3548** doesn't feature a guard terminal, as this portable resistance meter is typically used for lower resistances. Lower resistances mean that predominantly higher measurement currents are used for the measurements, making the "grounding of the shield" of the test lead unnecessary. Also, above mentioned **RM3545** resistance meter has a largest resistance range of 1200 MOhm, while the **RM3548's** largest resistance range is "just" 3.5 MOhm.

Like the bench models **RM3544** and **RM3545**, the **RM3548** also supports the **L2105** Comparator Attachment. And like the bench models the **RM3548** offers a temperature correction and temperature conversion function. That said, bear in mind that the temperature sensor for the **RM3548** is called **Z2002**, which is a different one than the **Z2001** used for the bench models.

Conclusion:

Multimeters without any doubt offer a huge range of functions that make it one of the most important test tools on a lab bench. At the same time there are requirements where dedicated resistance meters can make a real difference.

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