

Product Group: Vishay Foil Resistors

High-Accuracy Digital Multimeters



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With their long-term stability and low TCR, thermal EMF, and noise, Vishay Foil Resistors' Bulk Metal® Foil resistors helped Transmille achieve unrivalled performance with its 8000 series digital multimeters.

Industry/Application Area: Precision instruments

Product Used:

- 300190 Bulk Metal® Foil high-precision resistor network
- VCS331 and VCS332 Bulk Metal Foil high-precision current sensing resistors
- VHD200 Bulk Metal Foil high-precision, hermetically sealed voltage divider
- VHP202Z Bulk Metal Z-Foil ultra-high-precision, hermetically sealed resistor

The Challenge

To achieve outstanding accuracy and linearity, the choice of components was critical in the design of Transmille's 8000 series of precision 8.5-digit and 7.5-digit DMMs, especially when it came to choosing a resistor. Transmille required devices with low TCR, long life, low thermal EMF, and low noise to ensure high precision, repeatability, long-term stability, and minimal harmonic distortion.

The Solution

To meet the requirements for the 8000 series, Vishay Foil Resistors' (VFR) 300190, VCS331, VCS332, VHD200, and VHP202Z Bulk Metal Foil resistors provide TCR of <math><1 \text{ ppm}/^\circ\text{C}</math> maximum, low PCR of 5 ppm at rated power, load-life stability of $\pm 0.005\%$ at 70°C for 2000 hours or $\pm 0.015\%$ for 10,000 hours, thermal EMF of $<0.05 \mu\text{V}/^\circ\text{C}</math>, and non-measurable noise.$

Analog circuits in equipment such as the 8000 series DMMs require resistors to have a minimal drift from their initial values when operating above $+25^\circ\text{C}$ and in humid environments. VFR resistors provide stabilities well under the maximum allowable drift through thousands of hours of operation under harsh conditions.

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Harmonic distortion is another important consideration in the choice of precision resistors for high-accuracy applications. A significant signal voltage across the resistor may change the resistance value depending on the construction, material, and size. Under these conditions Bulk Metal Foil resistors — based on the planar construction of a cold-rolled Ni-Cr foil bonded to a flat ceramic substrate — behave more linearly than other resistor types.

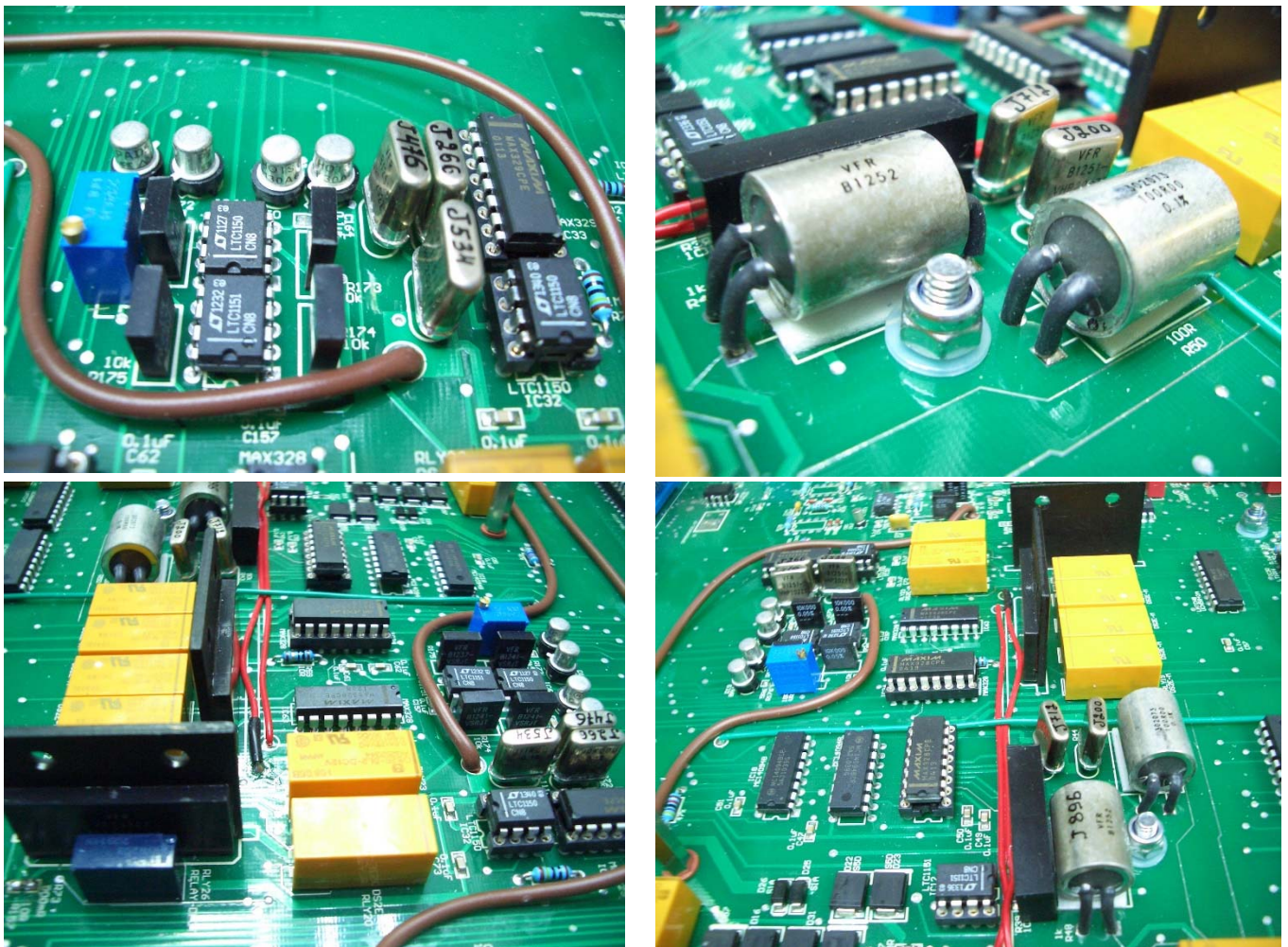


Figure 1: Bulk Metal® Foil resistors mount inside the 8081 precision digital multimeter

The User Explains

The heart of any precision instrument is in its analog design. At this level, every effect from thermal EMF to leakage must be eliminated if 8.5-digit performance is to be achieved. The low TCR and thermal EMF of VFR's Bulk Metal Foil resistors are critical to the accuracy of the 8000 series. In addition, the circuit incorporates the latest in analog chopper stabilized op-amps, low-leakage switches, and a temperature-stabilized zener reference chip providing stability of 1 ppm/year. To give stable readings in noisy environments, the measurement cycle is phase-locked to the mains power.

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Complementing the analog design of the 8000 series is a state-of-the-art digital design. Offering a multi-processor design, the 8000 series makes full use of today's low-cost digital processing power. Low-level processors handle the measurement ranging and A to D control, while a single-chip, 32-bit high-performance processor handles data management. Circuitry that would have taken up complete circuit boards just a few years ago is now available on a single chip, improving reliability, reducing power, and lowering cost, while at the same time improving performance.

For more information on the 8000 series, please visit

http://www.transmillecalibration.com/category_s/46.htm and http://www.transmille.co.uk/8000_multi_menu.htm.



Figure 2: Transmille 8081 precision digital multimeter

“By bringing together the latest technology in both analog and digital design, we have significantly reduced the parts count and the complexity of an 8.5-digit multimeter. With VFR's Bulk Metal Foil resistors, we have been able to achieve unrivalled performance at a breakthrough price. ”

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Acknowledgement:

Transmille was founded by James Bailey and Stuart Hawkins in 1997 as a UKAS-accredited calibration laboratory. The company quickly expanded as a precision instrument manufacturer, using its specialized knowledge of calibration industry requirements to produce a ground-breaking range of calibrators, including the first dedicated electrical test equipment calibrator. Today, Transmille's product range consists of four main categories: multi-product calibrators, precision digital multimeters (DMM), electrical test calibrations, and calibration laboratory software.

<http://www.transmille.co.uk/>

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