

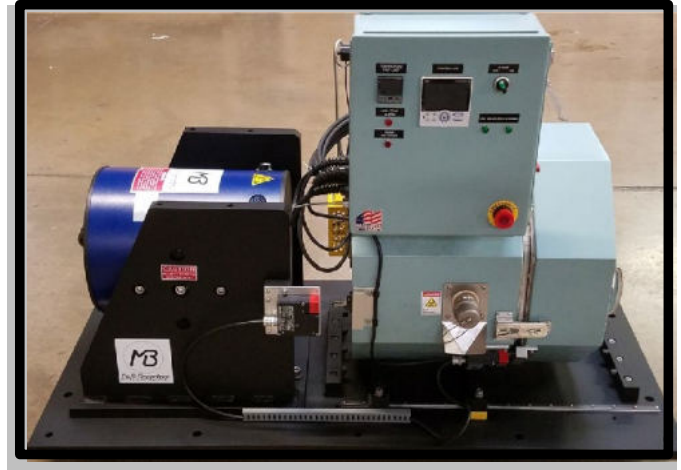
MB Win475 HL-BLUE and HL-RED

Extreme Range Temperature Sensitivity Calibrations
and Vibration Transducer Performance Verifications

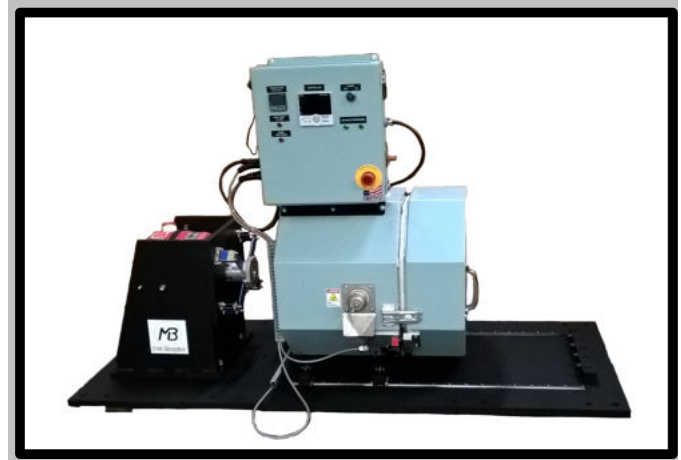
Overview:

Within extreme environments and harsh-duty applications, such as gas turbine, jet engine, and automotive engine and exhaust R&D, the need for reliable acceleration, pressure, temperature and strain measurements is essential. The vibration transducers used within these applications must reliably operate over continuous temperatures above +400°C, intermittent duty temperatures above +700°C, and large thermal cycling excursions of +600°C. Harsh external environmental conditions, such as those found in the Arctic tundra or in high altitudes, can further complicate test setups and create measurement uncertainty.

With these factors in mind, careful attention must be paid to the proper development, specification and calibration of the vibration transducers and cabling used within such extreme applications. This creates new requirements for transducer stability and reliability validations, including thermal performance characterizations and sensitivity curve development over the full extreme end-user temperature range. The MB Win475 HL-BLUE and HL-RED systems were expressly designed to support these critical testing needs.



MB Win475 HL-BLUE



MB Win475 HL-RED

Specifications:

Vibration Transducer Calibrations Performed:

- 1) At user-specified temperatures, after soaking at a select temperature and frequency
- 2) At user-specified frequencies, at every user-specified time interval, as temperature sweeps up or down
- 3) Across a user-specified frequency range, at a constant temperature
- 4) Amplitude linearity calibrations, at user-specified frequencies and temperatures

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Features:

- System components: MB Win475 HL-BLUE with ENERGIZER Blue exciter (optional ENERGIZER Red exciter, system designated as HL-RED); Cryofurnace (see below component specifications); and Win475 test scheduler software
- IEPE reference accelerometer (REF) with 100 mV/g sensitivity
- Subjects accelerometer under calibration (DUT) to controlled temperatures of +800°C to -185°C; no humidity control
- Calibrating at extreme temperatures (+800°C to -185°C) requires thermal insulation and spatial isolation of REF and exciter from hot and cold temperatures; >350 mm long ceramic stinger between exciter; REF and DUT provide needed thermal insulation and isolation
- System uncertainty of ±5% , when using flexible cable to connect DUT. System Uncertainty is higher as a result of additional factors necessary to system functionality such as stinger transmissibility, REF location (outside the oven and separated by the stinger), and temperature (use of hardline cable will increase system uncertainty)
- Measures DUT temperature sensitivity with high repeatability, while exciting at 160 Hz over full temperature range
- MB Win475 HL-BLUE system capable of vibrating at frequencies from 10 to 1500 Hz, at an amplitude of <25 g's pk, and at select frequencies over temperature range, for DUTs weighing up to 110 grams, limited by transmissibility and ceramic stinger stiffness
- MB Win475 HL-BLUE system calibrates accelerometers weighing up to 300 grams, over frequencies from 5 to 300 Hz, 10 g's pk, with ESU of 5% over the full MB Win475 HL-BLUE temperature range
- MB Win475 HL-RED system has very stiff internal and external flexures to support long cantilevered stinger with concentrated end mass from DUT and hardline cables (small shaker cannot react overturning forces from hardline cables)
- ENERGIZER Red exciter vibration: ≤10 g pk at 160 Hz; amplitudes at 10 to 1000 Hz, as determined by stiffness and transmissibility of stinger and DUT mass (please consult factory for complete ENERGIZER specifications)

Cryofurnace:

- Direct injection of liquid nitrogen (customer-supplied LN₂) achieves cold temperatures with advantages over compressor-based refrigeration
- Front opening door Cryofurnace internal dimensions: 200 mm dia. X 600 mm long
- Side exit for transducer cables, including hardline cables commonly used with high-temperature transducers
- Rated for 7 KW, 240 VAC, 50/60, 1-phase
- Vibration from ENERGIZER Blue exciter, oriented horizontally, allows LN₂ to collect in bottom of Cryofurnace and avoid leaking onto shaker
- Power supply has microprocessor controller, allowing either manual programmable control via pushbutton or software control via RS232 linked to Win475 PC
- Temperature control: ±2°C at control thermocouple to ±10°C user-selectable; air temperature heat-up rate of >+20°C to +500°C; faster for cool-down
- Microprocessor temperature controller can control to ±2°C, but injections of LN₂ can cause temperature oscillations that take time to stabilize, hence a default setting of ±10°C. Controlling to ±2°C may take a significant amount of time for oven stabilization and to begin measurements

Win475 Test Scheduler Software:

- Reads thermocouple and controls heating elements and LN₂ valves to achieve setpoint temperatures
- Automatically sequences Cryofurnace ramp times, setpoint temperatures, dwell times, etc.
- Automatically activates vibration and measures sensitivity once Cryofurnace achieves setpoint temperatures
- Includes automatic alarms and aborts
- Designed for unattended operation and safe unattended shutdown

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