MAGNAFLUX
A Division of Illinois Tool Works Inc.

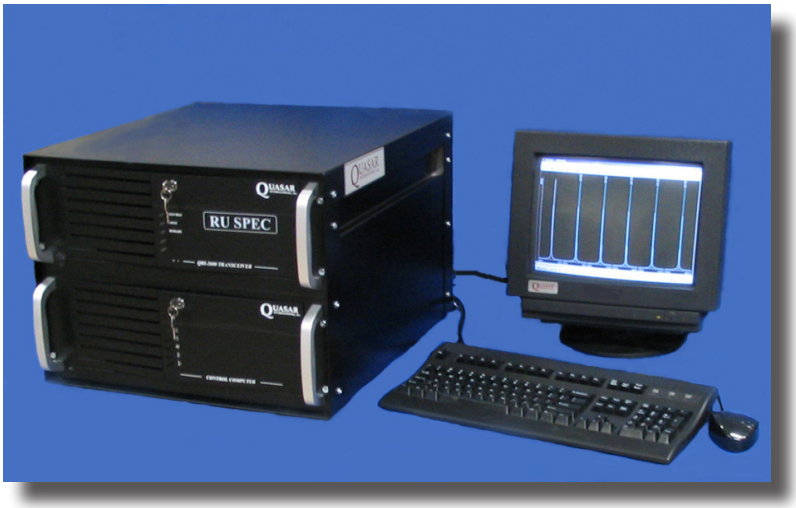
RUSpec

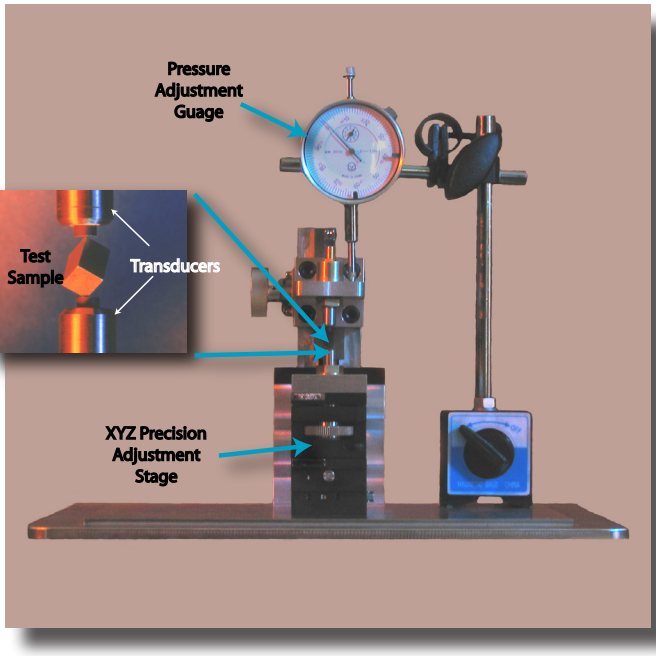
Quasar RUSpec – Resonant Ultrasound Spectrometer

The RUSpec (Resonant Ultrasound Spectrometer) is an integrated system for measuring material elastic constants based on technology originally developed at Los Alamos National Laboratory. "The RUSpec measures the resonant frequencies of sample materials of known dimensions, shape, and mass (or density). These measured resonances are compared with calculations of the modal frequencies based on an initial "guess" of the elastic constants. Typically, the guess is an educated one and is close enough to the actual value(s) so that the calculational software can provide a solution. The solution is derived by using the Levenberg-Marquardt iteration to minimize the difference between the measured and calculated resonant frequencies as the estimated elastic constants are iteratively changed. When a best fit between the measured and calculated resonant frequencies is achieved, the elastic constants have been calculated. Accuracy is greatly influenced by how good the sample (a rectangular parallelepiped or right cylinder) is made and whether or not the sample is uniform and without flaws.

Features

- For isotropic materials, one set of measurements determines:
  - √ Shear Modulus
  - √ Young's Modulus
  - √ Bulk Modulus
  - √ Poisson's Ratio
  - √ Density
- Calculates all independent elastic constants with one set of measurements. for isotropic, cubic, hexagonal, tetragonal and orthorhombic structures
- Provides extraordinary accuracy (capable of better than or equal to 0.1%) for large and small unflawed sample sizes
- Rapidly determines elastic constants versus. temperature





RUSpec Measures

- Resonant spectra for hard materials (metals, ceramics, and some composites) and calculates Elastic Constants (Cij) for rectangular parallelepipeds and cylinders
- Samples from millimeters in size to greater than 10 centimeters
- From liquid helium temperatures to temperatures in excess of 1850 °C (high and low temperature fixtures not provided)

RUSpec Products

- RUSpec measurement system
- RUSpec Software Suite Containing:
  - √ RUSpec Data Acquisition Software
  - √ RPModel Analysis for Rectangular Parallelepipeds (RP)
  - √ RPCyl Analysis for Cylinders
  - √ RPR for calculating RP Solutions
  - √ RPCYL for calculating Cyinder Solutions
- Micro Nest (left) for small (< 2.5 cm samples) or a Universal Nest for larger samples

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Specifications

Overall Accuracy
- Typically 0.1% is easily achievable with high purity samples
- May achieve 0.01% depending on sample purity and shape conformance

Total System Power Requirements (Standard North America Configuration)
- Voltage: 115 VAC ± 10%, Single Phase
- Max Current: 3 Amps
- Power Dissipation: 350 Watts

Frequency Range
- 1 kHz to 3 MHz, nominal

Frequency
- Accuracy: 0.01% (Considers fixturing repeatability, etc.)
- Stability: 0.005% (Over the operational lifetime for the specified operating environments)

Temperature
- Operating: 0° to 45° C (40° to 115° F)
- Storage: -10° to 60° C (15° to 140° F) non-condensing atmosphere

Humidity
- 0 to 95% (non-condensing)

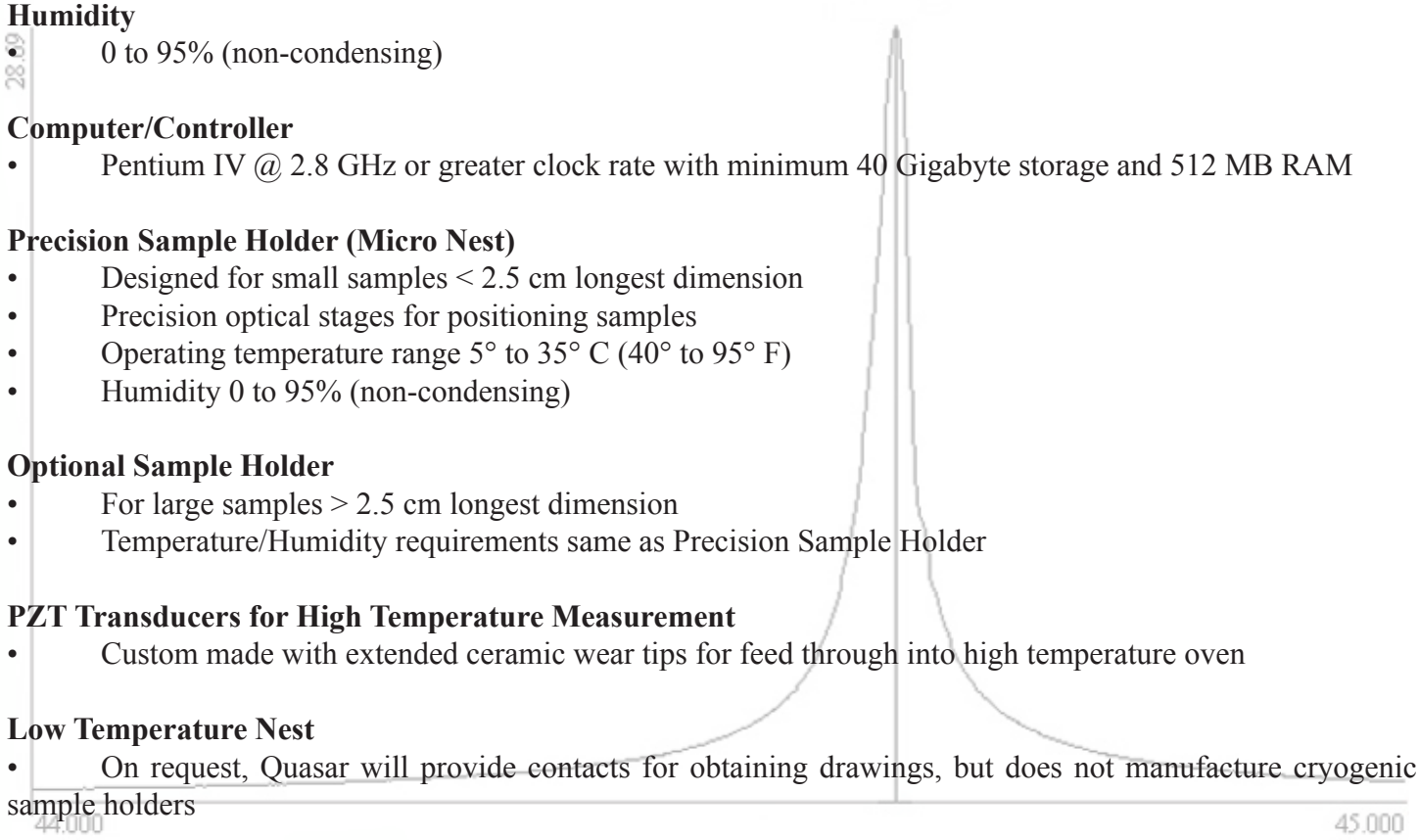
Computer/Controller
- Pentium IV @ 2.8 GHz or greater clock rate with minimum 40 Gigabyte storage and 512 MB RAM

Precision Sample Holder (Micro Nest)
- Designed for small samples < 2.5 cm longest dimension
- Precision optical stages for positioning samples
- Operating temperature range 5° to 35° C (40° to 95° F)
- Humidity 0 to 95% (non-condensing)

Optional Sample Holder
- For large samples > 2.5 cm longest dimension
- Temperature/Humidity requirements same as Precision Sample Holder

PZT Transducers for High Temperature Measurement
- Custom made with extended ceramic wear tips for feed through into high temperature oven

Low Temperature Nest
- On request, Quasar will provide contacts for obtaining drawings, but does not manufacture cryogenic sample holders



Windows© Operating Software – Windows XP or later