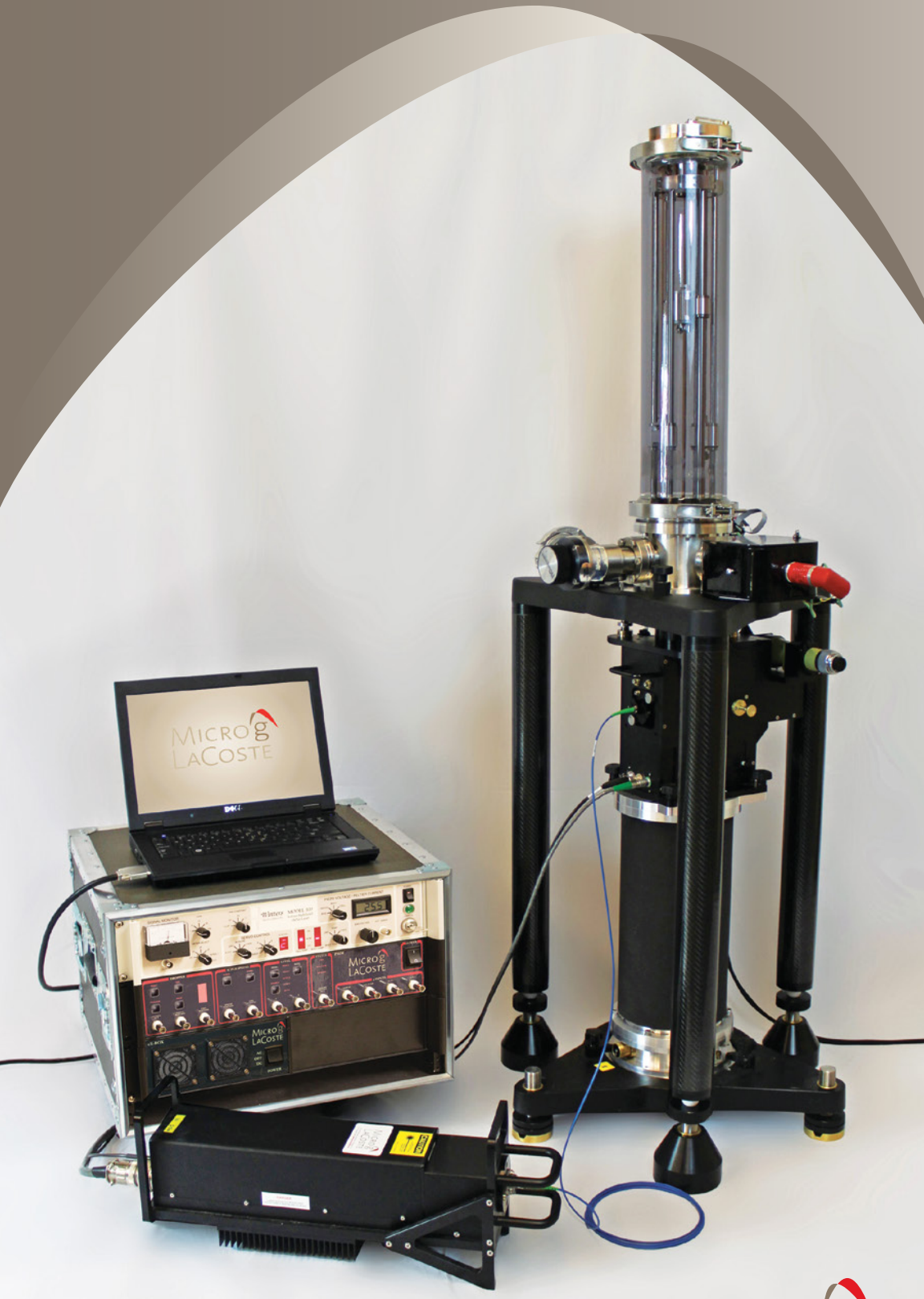
FG5-X
ABSOLUTE GRAVITY METER

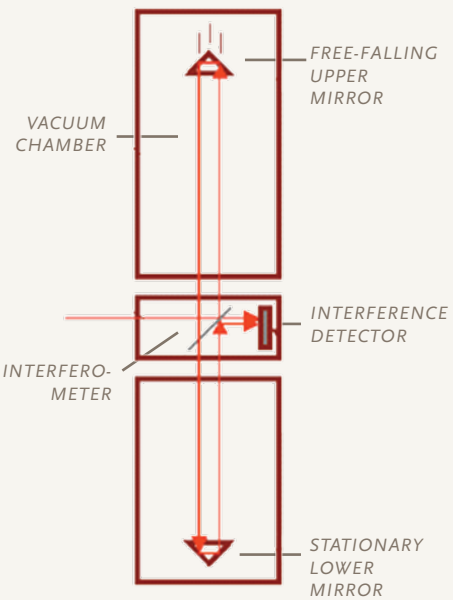


MICRO g
LACOSTE
A DIVISION OF LRS

Since its introduction in 1995, the FG5 has become the industry standard in absolute gravity instrumentation, and now Micro-g LaCoste is proud to produce the latest version: the FG5-X. Based directly on international standards of time and distance, the FG5-X provides unparalleled accuracy and precision. Whether applied in geophysical research, environmental monitoring, or laboratory metrology, the FG5-X is still the highest quality, most versatile absolute gravimeter available today.

PRINCIPLE OF OPERATION

The FG5-X operates by using a free-fall method. An object is dropped inside a vacuum chamber and its position is monitored very accurately using a laser interferometer. In 2004, the BIPM (Bureau International de Poids et Mesures) proclaimed the ballistic free-fall method as an official primary method for measuring gravity.



The free-fall trajectory of the dropped object is referenced to a very stable active-spring system called a “Superspring”. The Superspring provides seismic-isolation for the reference optic to improve the noise performance of the FG5-X.

The optical fringes generated in the interferometer provide a very accurate distance measurement system that can be traced to absolute wavelength standards. Very accurate and precise timing of the occurrence of these optical fringes is done using an atomic rubidium clock that is also referenced to absolute standards.

The measurement is directly tied to international standards, and this is what makes the FG5-X an absolute gravimeter. By basing the measurement on these standards, the system is inherently calibrated and will neither drift nor tare over time.

INSTRUMENT FEATURES

- Automatic data acquisition and system controller (Microsoft Windows®-based laptop PC).
- Real-Time data processing.
- Automatic data storage.
- Environmental Monitoring Package: includes automatic logging of barometric pressure, ambient temperature and other system information.
- Real-time gravity corrections for tides, ocean loading, polar motion, and atmospheric attraction.
- "Superspring" long period (30-60s) active isolation device.
- Built in collimation optics for verticality alignment.
- Drag-free chamber eliminates residual drag on the free-falling object.
- Frequency stabilized HeNe laser (Iodine stabilized HeNe laser option available for highest accuracy applications).
- Built in Rubidium atomic clock.
- Ion-vacuum pump with battery backup power supply.
- Custom-built shipping containers.

GENERAL SPECIFICATIONS

TOTAL SHIPPING WEIGHT	150 kg in 6 containers
TOTAL VOLUME	1.5 m^3
FLOOR SPACE REQUIREMENT	3 m^2
INPUT VOLTAGE	110-240 VAC, 50-60 Hz
NOMINAL POWER REQUIREMENT	~500 W

PERFORMANCE SPECIFICATIONS

ACCURACY	2 µGal (observed agreement between FG5-X instruments)
PRECISION	15 µGal/$\sqrt{Hz}$ at a quiet site [eg. ~1 µGal in 3.75 minutes, or 0.1 µGal in 6.25 hours]
OPERATING DYNAMIC RANGE	Worldwide
OPERATING TEMPERATURE RANGE	20°C to 30°C

NEW FG5-X FEATURES

NEW SLIM-LINE, TRANSPARENT CASING DROPPING CHAMBER

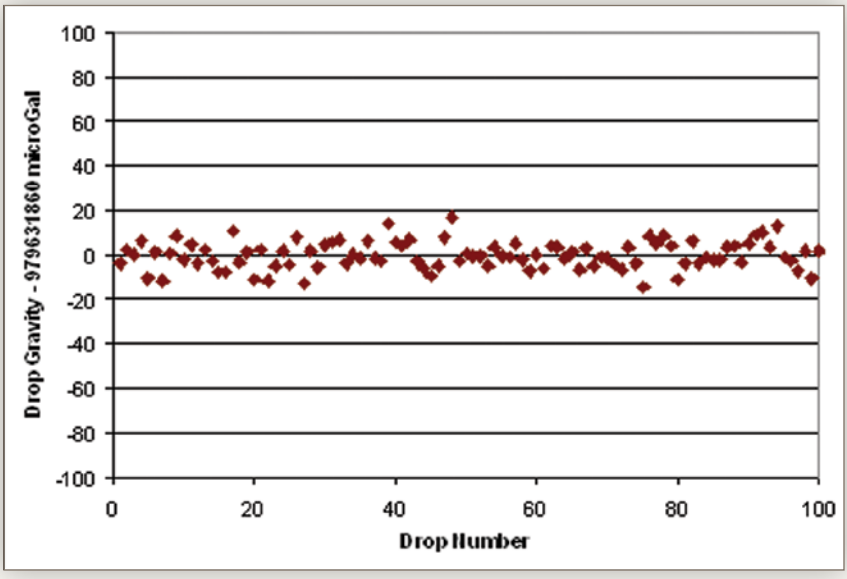
- Extended free-fall length (35cm).
- New test mass design reduces decelerations caused by any external magnetic fields.
- Redesigned drive system, including:
  - Counter-weighted elevator to reduce mechanical recoil and air gap modulation.
  - Improved microprocessor servo-controller.
  - Increased motor power for better tracking.
  - In-line drive system to reduce horizontal accelerations (Coriolis) of test mass.

NEW SYSTEM INTERFACE MODULE (SIMx) PROVIDES SMALLER, LIGHTER, AND MORE ROBUST ELECTRONIC CONTROL:

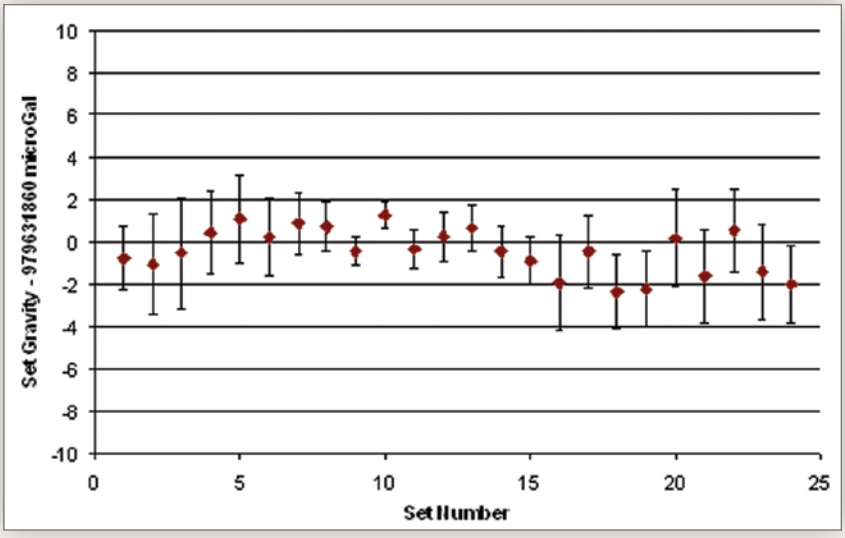
- Reduces size of total electronics by two full rack units.
- Includes Dropper Controller.
- Includes Superspring Controller.
- Includes System A/D interface (eliminates NI A/D computer card).
- Optional system leveling control.
- Includes Integrated, GPS-disciplined rubidium timing system.
- USB integration for communication with new g-software.
- Provides feedback from electronics to warn user if:
  - Superspring is not locked or is out of range.
  - Dropping Chamber is not in drop mode.
  - Remote operation of FG5-X through the internet.

UPGRADE PATH AVAILABLE FOR USERS OF ORIGINAL FG5 SYSTEMS.

EXAMPLE DATA DESCRIPTION



Shown above are individual measurements in a laboratory setting. The standard deviation between drops is better than 6 µGal. Note that the measured absolute gravity value, in this case 979 631 858 µGal, is computed and reported in real time.



Shown above are the results of a 24-hour site occupation (24 sets of 100 drops each). The set scatter is on the order of 1 µGal, indicating sub-µGal measurement precision.

FG5-X APPLICATIONS

GEOPHYSICAL RESEARCH

- Vertical crustal motion detection.
- Complementary verification of displacements measured with GPS and VLBI.
- Volcanic magma flow monitoring.
- Postglacial rebound studies.
- Uplift of subduction studies.
- Earthquake research.
- Long period tidal monitoring and earth inelasticity modeling.

ENVIRONMENTAL MONITORING

- Water table monitoring in deep and/or multiple aquifers.
- Nuclear waste management and cleanup.
- Global sea level studies for global warming.

EXPLORATION AND RESOURCE MANAGEMENT

- Oil exploration.
- Mineral exploration.

PRECISION MEASUREMENTS AND CALIBRATIONS

- Pressure transducer and load cell calibration.
- Redefinition of the kilogram in the SI system of units.
- Big G determinations and equivalence principle.
- Calibration of superconducting or other high precision relative gravity meters.

INERTIAL NAVIGATION

- Gravity reference station determinations.
- Relative gravity network control points.
- Establishing geodetic tie points for gravity networks.
- Defining the geoid.

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