Moment of Inertia

Moment of Inertia Measuring Equipment

Moment of Inertia Measuring Instrument

Moment of Inertia measurements can be taken in a matter of minutes on complex geometry and multi-material composition parts that would normally take hours of CAD design work or engineering calculations. The Inertia Dynamics Moment of Inertia Measuring Instrument is capable of measuring parts through any axis and parts with offset center of gravity. Also, our machine is not subject to errors caused by assumed densities and dimensional tolerancing. Since Moments of Inertia are critical in all rotating machinery, ballistics, projectiles, or aerospace hardware, these instruments are invaluable time-saving, cost-saving tools for design, quality assurance, and reliability engineers. These instruments are used widely as quality assurance tools to check the consistency of production parts where MOI is a critical design parameter. Inertia Dynamics offers a choice of 2 standard models for parts to 25 lbs.

Moment of Inertia Measuring Instruments operate on the principle of an inverted torsional pendulum, providing a stable platform on which to mount test parts. The instrument platform is restricted to one degree of freedom. This eliminates random motions normally present in hanging torsional pendulum measuring methods.

Method of Operation

The test part is mounted on the instrument using a holding fixture, which is screwed to the instrument interface head (see instrument specifications for diagram). The oscillation lever is then indexed to the starting position and released. The period of oscillation and MOI is then determined and displayed by the microprocessor-based embedded controller in units of your choice. A simple press of a key allows instant conversion into any other engineering unit. At the same time, the measurement is being logged with time and date stamp for future recall.

MOI Calculations

Calculate Moment of Inertia of the test part as follows:

$I = CT^2 - Ct^2$ or $I = C(T^2 - t^2)$

Where:

- I = Moment of Inertia of test part
- C = Calibration constant for instrument
- T = Period of oscillation of test part, holding fixture and instrument
- t = Period of oscillation of holding fixture and instrument

The calibration constant (C) is determined by measuring the period of oscillation of a known Moment of Inertia or calibration weight as follows:

$$C = \frac{I \text{ (calibration weight)}}{T^2 - t^2}$$

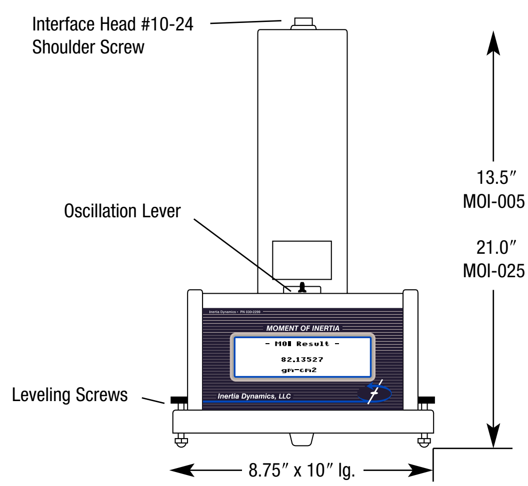
Where:

- I = Calculated MOI of calibration weight
- T = Period of oscillation of calibration weight and instrument
- t = Period of oscillation of instrument only

The instrument is linear, therefore the calibration constant need not be changed when measuring different size or weight parts.

Features

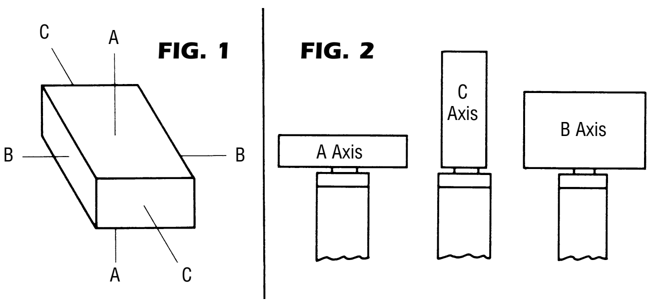
- Accuracy of ±0.5% measurable MOI
- Four-line backlit LCD display for operator prompts and data
- Sealed membrane keypad with tactile keys for easy location and operation
- MOI calculations and conversions performed internally
- Offset CG calculations for parts that will not be rotated on their CG
- Constant monitoring of repeatability of timings to assure stability and detect false readings
- Easy-to-operate menu driven interface
- Unit may be recalibrated in field without a PC
- Automatic preload option for use in secure environments



Moment of Inertia

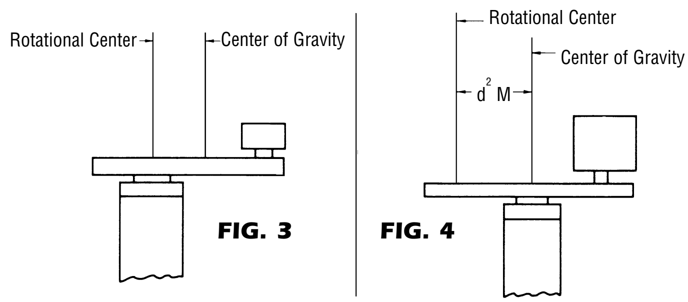
Method of Operation

Measuring Parts Through More than One Axis



Instruments will measure the Moment of Inertia of any test part about any axis. Fig. 1 depicts three basic axes. Fig. 2 shows the mounting method for the three basic axes. The test parts can be measured about the rotational center even though the center of gravity does not coincide with the rotational center.

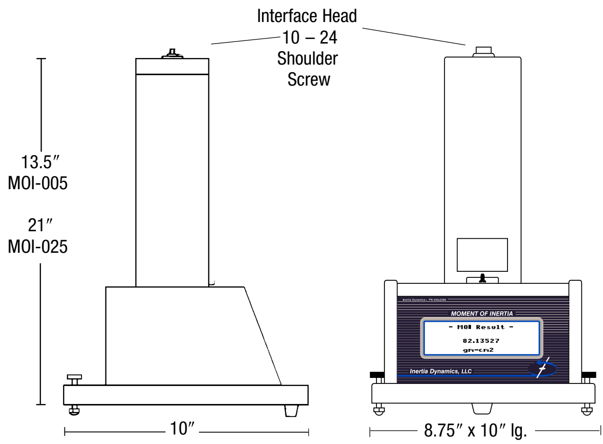
Measuring Parts with Offset Center of Gravity



Test parts with a small CG offset may be measured directly about their rotational center as in Fig. 3. Test parts with a large CG offset should be shifted and measured about their CG. The MOI about the rotational center can then be determined by adding the measured MOI value – d^2M – (where d = distance between CG and rotational center and M = mass of test part weight; or weight if gravitational system of units is used) Fig. 4.

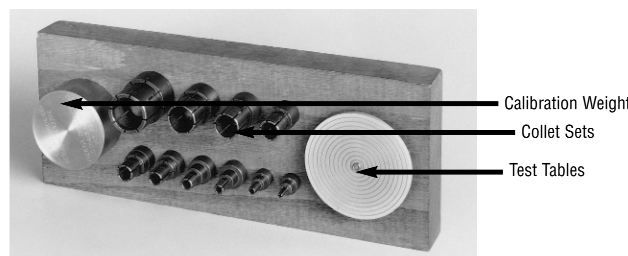
CHARACTERISTICS & BENEFITS	INERTIA DYNAMICS MOI INSTRUMENT	COMPUTER AIDED DESIGN
Speed	Fast & Easy	Slow technical calculations & drawing generation
Accuracy	±0.5%	Depends on assumed values of input
User-Friendly	Anyone can use	Must be proficient in CAD
Determination Method	Measured data	Calculated data
Complex Shapes	No problem (±0.5%)	Extended calculations compounding error
Multi-Material	No problem (±0.5%)	Extended calculations compounding error
Production Inspection	Yes	No
Quality Control	Yes	No

Instrument Specifications



MOI-005 and MOI-025

MODEL NO.	MAX. WEIGHT CAPACITY (LBS.)	MIN. MOMENT OF INERTIA (OZ-IN-SEC²)	DESCRIPTION
MOI-005-004	5	9.9×10^{-5}	Table Model-Manual
MOI-005-104	5	9.9×10^{-5}	Table Model-Automatic
MOI-025-004	25	6.9×10^{-4}	Table Model-Manual
MOI-025-104	25	6.9×10^{-4}	Table Model-Automatic



Accessories

CALIBRATION WEIGHTS			TEST TABLES			COLLET SETS*				
PART NO.	FITS INSTRUMENT NO.	WEIGHT LBS.	PART NO.	FITS INSTRUMENT NO.	TABLE DIA.	SET NO.	FITS INSTRUMENT NO.	COLLETS PER SET	SHAFT SIZE	HOLE SIZE
CW005 – 001	MOI – 005	0.75	TT005 – 001	MOI – 005	2.5"	CS01 – 001	MOI – 005	10	.125" to .750"	.125" to 1.000"
CW025 – 001	MOI – 025	5.0	TT025 – 001	MOI – 025	3.5"	CS01 – 001	MOI – 025	10	.125" to .750"	.125" to 1.000"

*Collets are designed to mount test parts that have holes or shafts.

Special Accessories: Inertia Dynamics is prepared to quote on special holding fixtures for such items as golf balls and golf clubs. Metric collet sets are available on special order.