

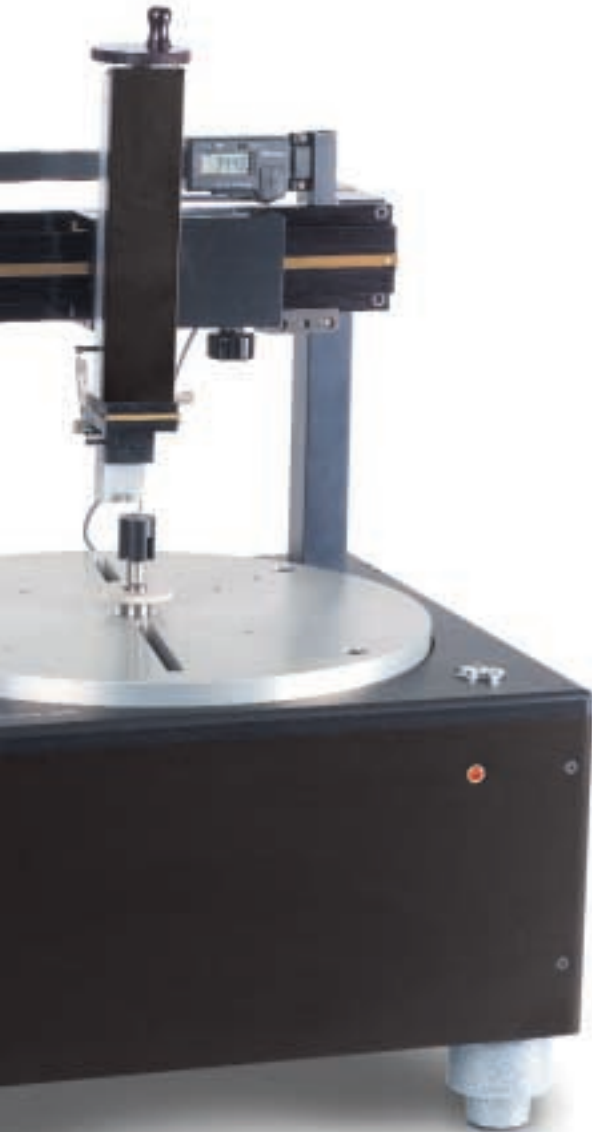
M15-W

Windows-based Universal torque tester
with TorqueScope™



MRI
MEASUREMENT
RESEARCH, INC.

The **M15-W** is the third-generation MicroTorque™ tester from Measurement Research, Inc. It uses the same linear load cell technology as previous generations, giving the same ease of use and low fixture dependency, combined with a new Windows-based system that offers many additional benefits.

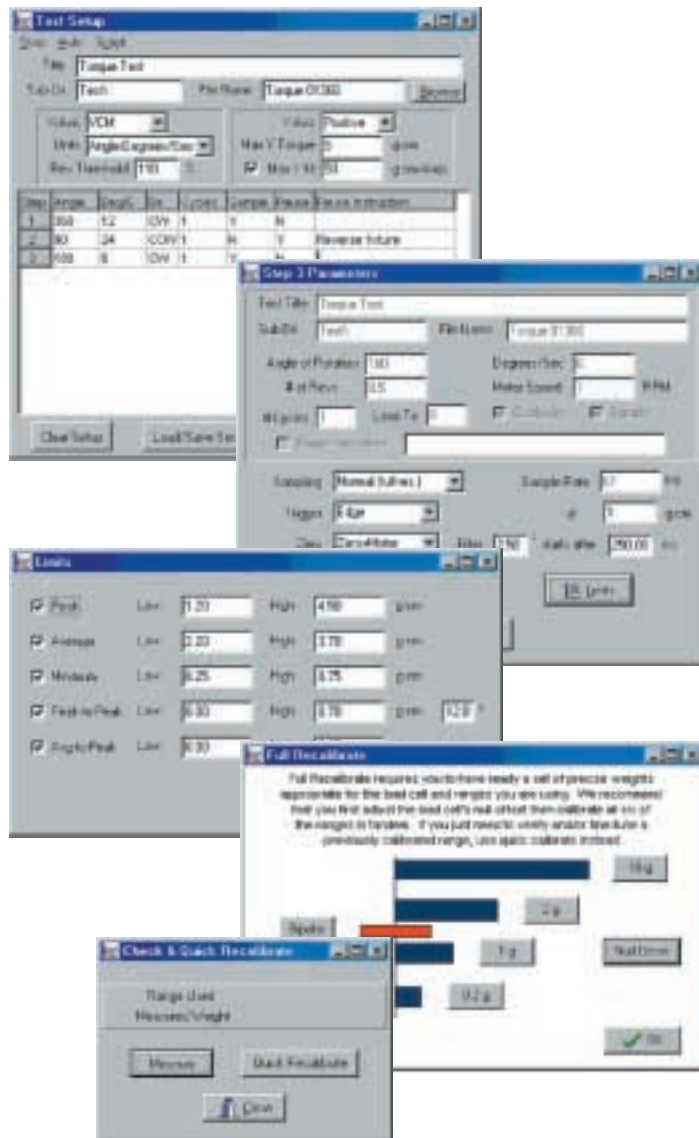
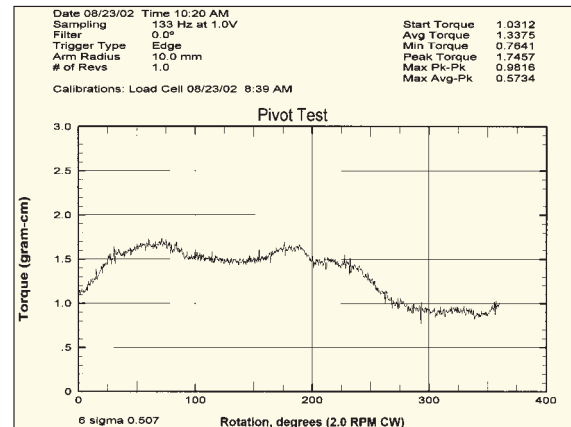


Features:

- Sensitive torque measurement pioneered by MRI has become the *de facto* standard for the disk drive, gyroscope and other industries needing analytical information on part rotation.
- MicroTorque™ analysis shows many bearing and pivot defects, including brinelling, contamination, raceway misalignment, preload, lobing, lubricant smoothness, retainer drag and other rotational issues.
- Inherently low noise level allows analytical torque measurements as low as 0.001 gm-cm (0.000014 oz-in).
- New TorqueScope™ Windows-based system runs on any computer with RS-232C serial port.
- Enhanced programming capability allows user to easily create an unlimited variety of tests for many different torque-measuring applications.
- Rotation profile can be programmed for any speed (up to 4 RPM, as low as 0.001 RPM with special gearbox), any angle, any direction, with or without data measurement, in any combination – with looping capability. Gives unprecedented flexibility in setting up custom tests.
- Direct compatibility with Excel, Word and other MS Windows-based programs. Test files can be automatically exported to Excel for further analysis.
- Flexible zoom, cross-hair measurement, overlay and multiple-window features allow quick visual inspection of torque features.
- Digital analysis of test data allows the user to set pass/fail criteria for most important torque functions, simplifying incoming inspection of parts. Test results can be logged to MS Excel compatible file.
- New multiple-range calibration procedure extends the accuracy of the load cell over its full 10,000:1 range. This particularly improves low torque measurement accuracy.

Principles of MicroTorque™ Testing

The M15 tester is a deceptively simple device. It provides a source of accurate, slow, vibration-free rotation to one component of a rotating part while measuring the force exerted by the opposite component. The M15 uses MRI's proprietary DC servo motor system that gives completely smooth rotation, with no cogging whatsoever, at speeds from 4 RPM to 0.05 RPM (0.001 RPM with special gearbox). At these very low speeds, there is no vibration to mask the very small changes in transmitted force that take place during rotation. When this rotation system is coupled to the sensitive force-measuring load cell, the M15 can detect the smallest variations caused by irregularities within the rotating components. Bearing brinelling, contamination, raceway misalignment, lobing and many other issues are graphically displayed on an easy-to-read trace.



TorqueScope™ Flexible testing for many applications

TorqueScope™ software gives a new level of flexibility in torque measurement. The intuitive user interface allows a test profile to be built step-by-step, specifying rotation angle, speed, direction and trigger and display conditions for each step. The user is immediately alerted to any testing inconsistencies and once a suitable test setup is developed it can be saved for future recall. Typical test setups are:

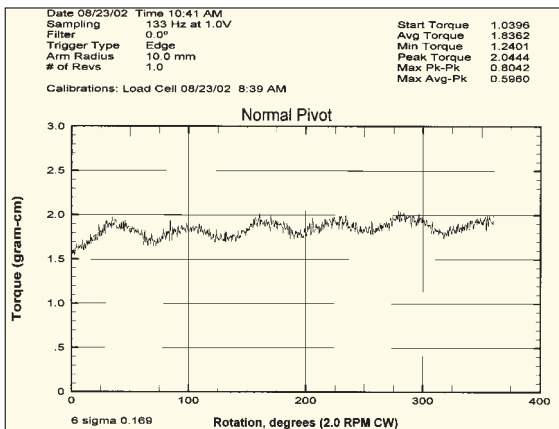
- Uni or bi-directional pivot/bearing torque
- Voice coil motor test with hard stop detection and motor Kt
- Spindle motor torque with phase and cogging overlay
- Flex circuit bias
- Disk drive airlock torque
- Media stiction
- HSA assembly torque
- Lobe detection (multiple revolution test)
- Gyroscope pivot stick
- Torque ranges .001 gm-cm to 10,000 gm-cm (.00002 - 140 oz-in)

Simple fixturing

The M15's 12-inch diameter platter with removable 1C collet allows quick fixturing of many test parts. The platter has a standard hole pattern for mounting custom fixtures and also has movable fences that can trap a rectangular part anywhere on the surface. Small round parts are easily held in the collet, while larger parts can be mounted on the platter. The X-Z linear stages that comprise the load cell carrier gantry allow positioning of the force measuring device anywhere over the platter surface. The X stage has a digital readout on position in inches or mm to facilitate measurement of torque arm radius.

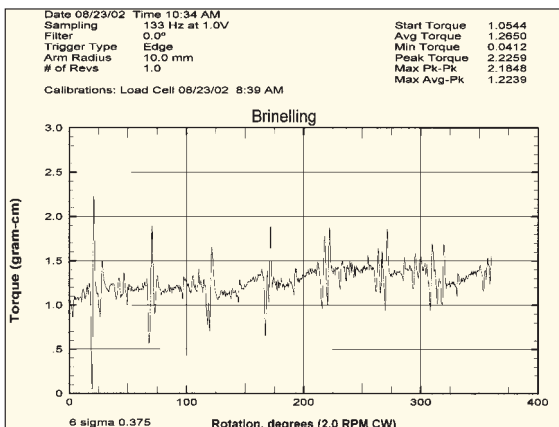


Test results



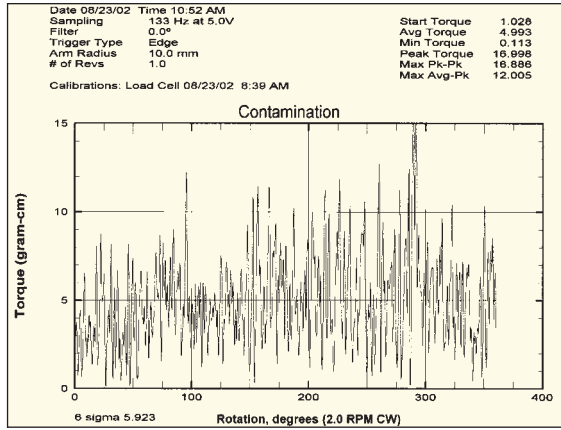
Normal test trace

Normal test – A “normal” test, like beauty, is in the eye of the beholder. The M15 is a very sensitive device and a perfectly made part may show many small variations during rotation. The important thing is to decide what is important to the application. The test shown here is typical of a disk drive pivot, showing even rotation over 360°. Small irregularities and the grease hash do not indicate any problems. In a typical ball bearing the inner race must rotate 3-4 complete revolutions relative to the outer race before the balls have moved around the raceways once. This means that consecutive 360° tests of the same part actually have different starting positions for the balls, causing apparent torque variation.



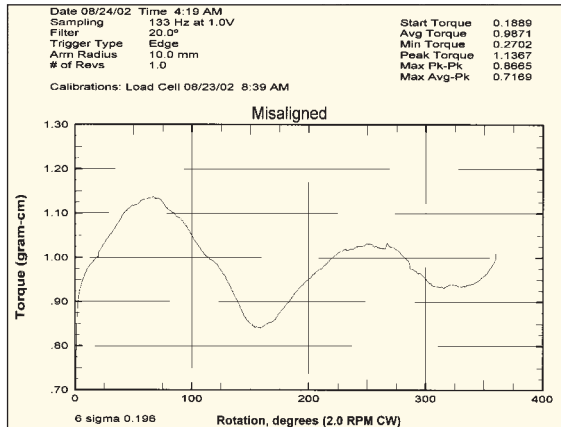
Brinelling test trace

Brinelling – Dented raceways (brinelling) are shown as a series of evenly-spaced spikes with the leading edge falling (the ball falls into the hole in the raceway before climbing out). Very severe brinelling may cause a rippling of the raceway, seen as multiple spikes. At this point, the damage can usually be felt by hand.



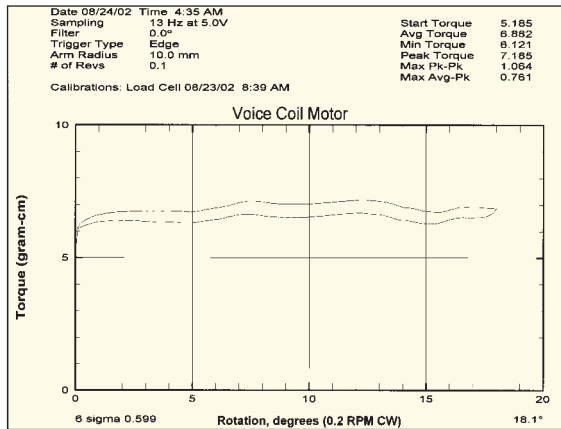
Contamination test trace

Contamination – Shown as irregular spikes with the leading edge rising (the ball must climb the contaminating speck before falling off the back side).



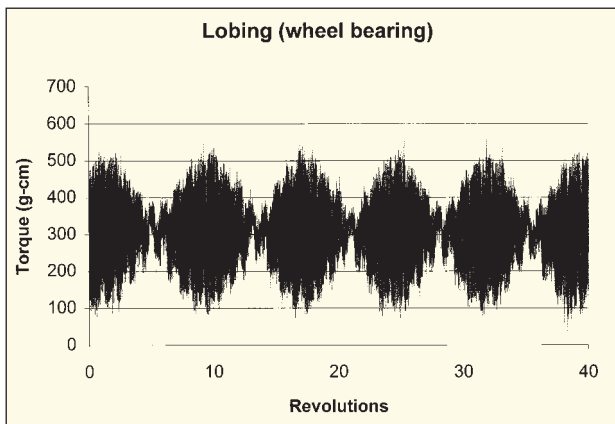
Misalignment test trace

Raceway misalignment – Sinusoidal torque variation over 360° is indicative of slight raceway misalignment.



VCM test trace

Voice coil motor (VCM) – This is an automatic test of the motor efficiency over the entire length of stroke of the motor. The test automatically reverses when the hard stop is encountered and the reverse stroke is overlaid as a reversed trace so that features will align correctly. Built-in current measurement allows display of Kt (gm-cm per amp).



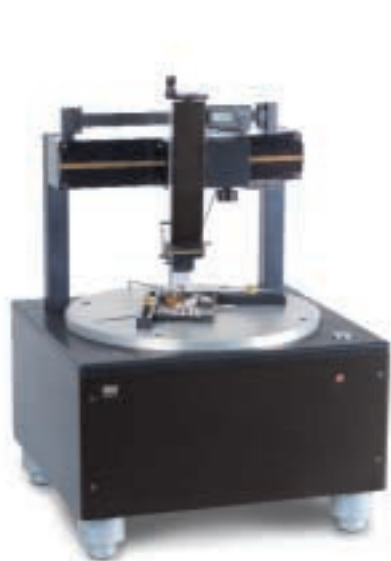
Lobing test trace

Lobing – Two different sinusoidal variations with periods much shorter and much longer than 360° are typical. This example is plotted in MS Excel using direct test export feature.

Specifications

Height:	24 in (61 cm)
Width:	15 in (38 cm)
Depth:	14 in (36 cm)
Weight:	92 lbs (43 kg)
Speed range:	0.05 to 4.0 RPM (standard gearbox)
Revolutions:	0.1 degrees to 999 revolutions
Minimum torque:	0.001 gm-cm
Maximum torque:	20 gm-cm to 10,000 gm-cm (depending on load cell)
Platter size:	12 in (30 cm)
Throat height:	6 in (15 cm)
System requirements:	Pentium II processor, Windows 98, 2000, ME, XP
Power:	100-120 VAC, 50/60 Hz.

Note: Measurement Research, Inc. reserves the right to change the above specifications without notice.



*M15 testing voice
coil motor in disk drive*



*Oven option allows
high temperature testing*

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