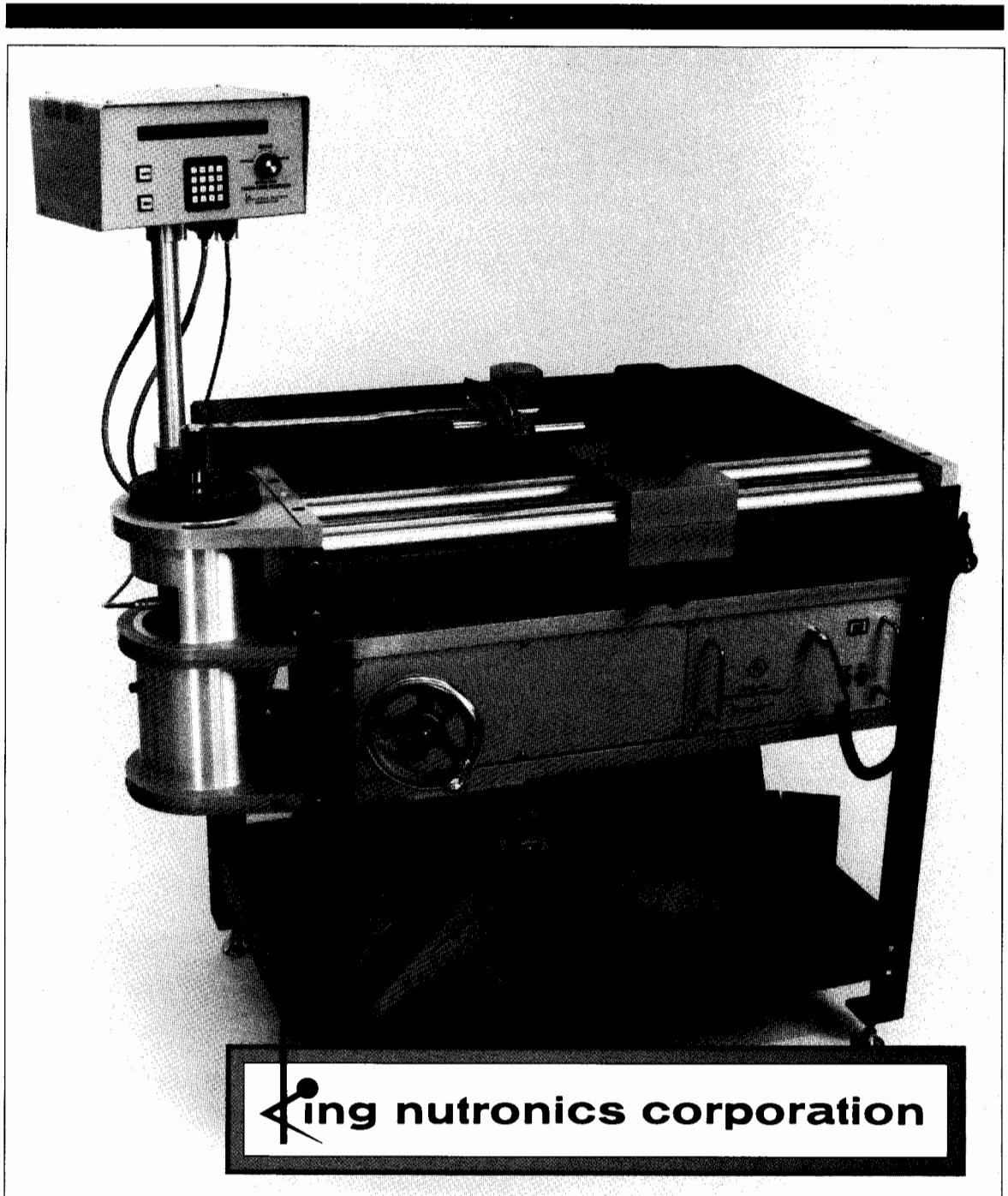


TORQUE AND FORCE CALIBRATOR

Model 3695



king nutronics corporation

Rapid and Accurate Torque and Force Calibration

The Model 3695 Torque and Force Calibrator is a self-contained, semi-automated, multi-functional calibrator which provides a rapid, highly accurate and safe means for calibrating and testing a wide variety of torque and force measuring instruments.

The functional layout is such that the operator can easily convert the system from torque applications to force and vice versa.

The Model 3695 has the capability to calibrate all types of torque wrenches*, torque multipliers, force gauges, cable tensiometers and cable testers throughout standard ranges from in-oz's up to 20,000 ft-lbs (torque) and 5,000 lbs. (force) with accuracies up to $\pm 0.5\%$ for torque applications and $\pm 0.125\%$ when in the force configuration.

Measurement ranges and corresponding accuracies are developed through the use of four torque transducers with overlapping ranges which can be selectively installed in the calibrator. The wide range of each transducer allows for complete testing of all standard test instruments without the need to change transducers during the test sequence.

The Model 3695 has been tested to, and complies with applicable environmental requirements, for shipboard use, of Military Specification MIL-T-28800.

The Model 3695 can be supplied either as a Torque and Force Calibrator (p/n 3695-1-1) which has full capability or as a Torque Test Bench Assembly (p/n 3695-1-3). The only difference between the two configurations is that accessories required for force testing are not furnished with the Torque Test Bench Assembly.

*Except impact/power type torque wrenches.

How It Works

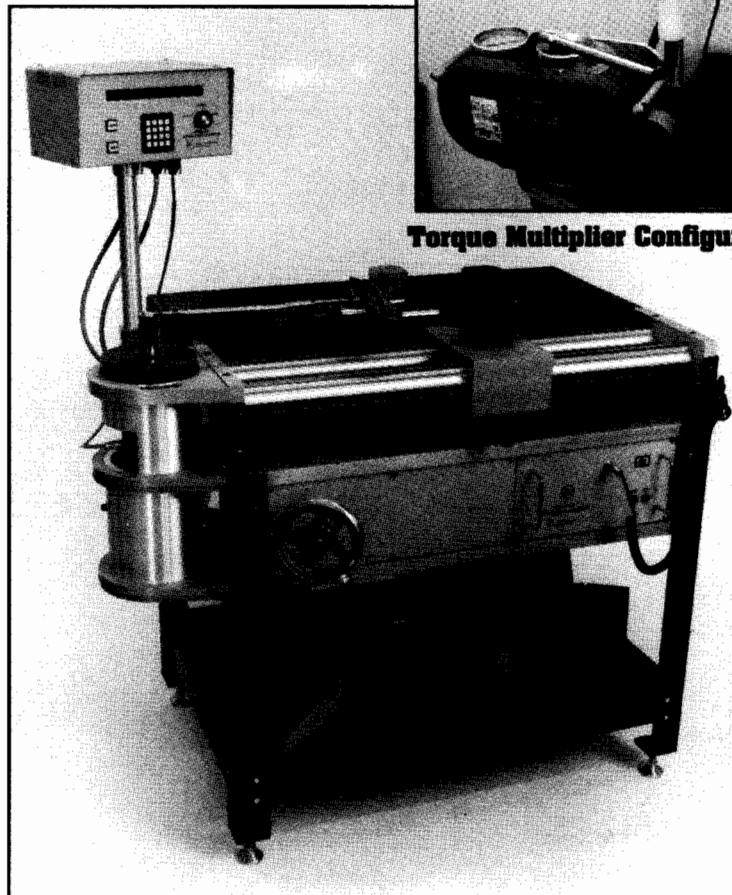
Torque loading is developed by a jackscrew actuator driven by a stepper motor and connected to a force arm. The input drive of the torque transducer is rigidly attached on the axis of the force arm and the output drive is coupled to the test instrument. If the test item is a force instrument, a sector arm is installed on the torque transducer output drive and the test item is connected, tangentially, to the other end of the sector arm.

All signal-conditioning, programming, and control functions are contained in a control console which is conveniently mounted above the test bench.

Does Not Require Highly Trained Technicians to Operate

Displayed messages prompt the operator on specific actions he must take throughout the test sequence. Warning signals both audible and visual warn the operator if an operational safety limit is exceeded.

Test configurations are easily set up using dedicated adapters furnished with the calibrator. Adaptors have been specifically designed not only to reduce the total number required but also to prevent unsafe operations.



Torque Wrench Test



Torque Multiplier Configuration

Torque Testing

Bi-directional testing of torque wrenches is accomplished by installing one of the torque transducers, with the proper range, into the drive mechanism of the calibrator. The output drive of the test instrument is then attached to the transducer through the use of an adapter. A reaction post, installed on a sliding carriage located on the test bench, is positioned over the handle of the torque wrench to provide the reaction force.

Test parameters (range, cw/ccw direction, and units of measure) are entered into the control console, by the operator via the keyboard when prompted by displayed messages. Entering test parameters establishes correct test routines and operational safety limits. Upon initiation of the test sequence the operator can control both speed and direction of applied torque through the use of the remote control terminal. Throughout the test, applied torque is continuously displayed and in the case of snap-action torque tools, peak torque at time of actuation is also displayed and retained until manually cleared.

Testing of torque multipliers is similar to testing torque wrenches except input torque is manually applied to the multiplier by a hand crank or a calibrated torque wrench. Output torque is measured by the torque transducer and digitally displayed. Fixtures and adapters for representative types of multipliers are furnished.

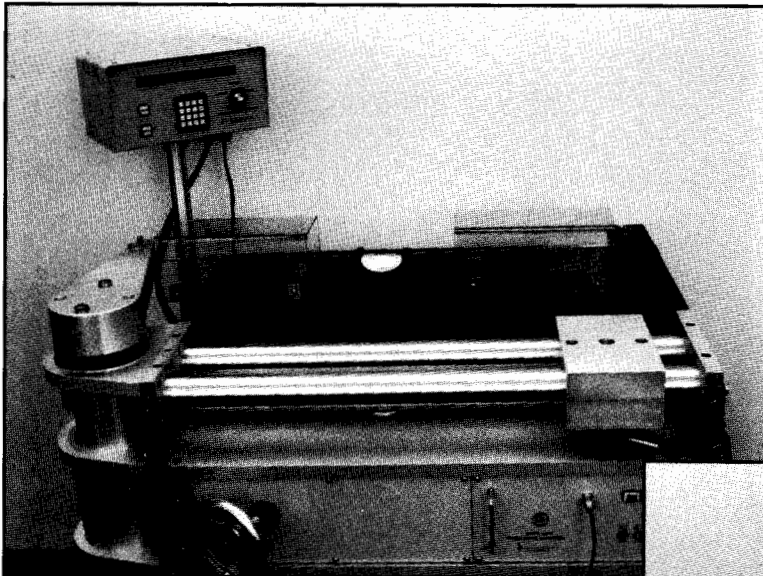
Force Testing

Testing of force gauges, cable testers and cable tensiometers is accomplished by installing the sector arm onto the torque transducer and connecting the force instrument to the arm using one of the test rods furnished with

the calibrator. When testing cable tensiometers a test cable is attached between the sector arm and an anchor block bolted to the test bench.

The method of applying and controlling the driving force is similar to the torque procedures with the exception that measured values are displayed in units of force.

Additional safeguards are also incorporated to ensure that test cable load limits are not exceeded, and two clear lexan safety shields are provided to cover test cable end connections to prevent personnel injuries in the event of a cable failure.



Cable Tensiometer Calibration



Force Gauge Testing

Calibration Support Plans - Model 3695

Measurement Reliability And Traceability

The technique developed for calibrating the Model 3695 is unique in that the four torque transducers and the control console are calibrated as a set. The primary reason for this method is that temperature and linearization coefficients for the transducers are stored in coefficient memory (EEROM) located in the control console and if an out-of-tolerance is observed during their calibration, new coefficients can be entered to correct the out-of-tolerance condition.

To facilitate calibration of "the set" a Calibration Transfer Standard (Model 3703) has been developed which is similar in design to the Model 3695 in that the transducers and control console are mounted exactly the same as the Model 3695. The input drive mechanism is also the same as on the calibrator.

The reference standards used for the measurement system consist of a quartz force gauge for the lower 50 ft-lb range and two proving rings which cover the range from 50 to 20,000 ft-lbs. The reference standards are traceable to the National Institute of Standards and Technology (NIST).

For additional information on the Model 3703 Calibration Transfer Standard or Custom Calibration Service contact King Nutronics Corporation.

Options For Assuring Timely Calibration Of Your Calibrator

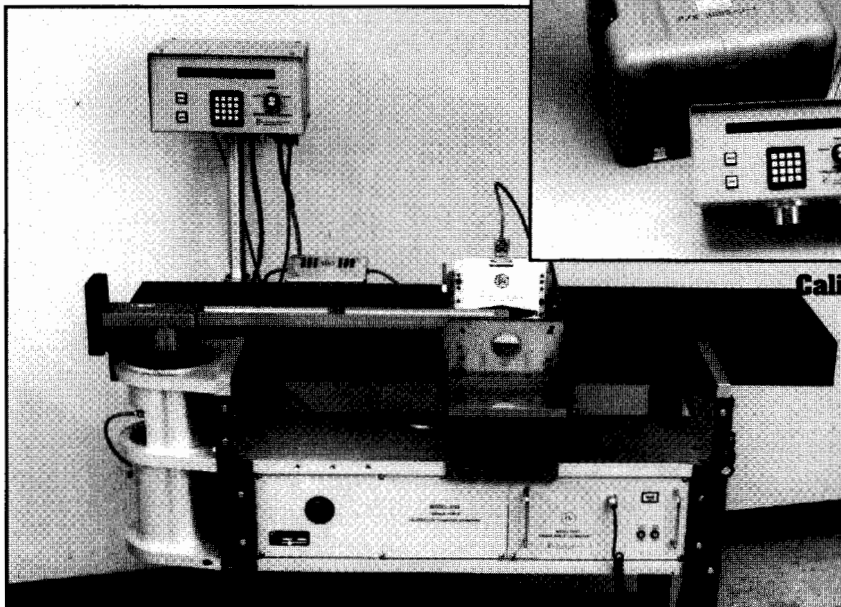
Calibration Transfer Standard

Organizations which plan to utilize several calibrators in their test and/or production facilities, where downtime for calibration must be tightly controlled, may find it advantageous to purchase the Model 3703 Calibration Transfer Standard. This would allow calibration schedules to be tailored to production time tables.

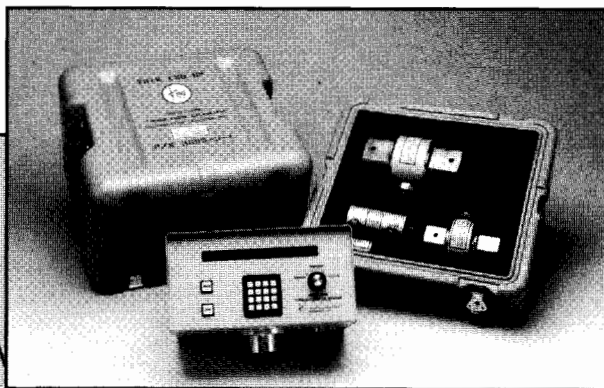
Calibration Exchange Kit

Another method which does not require an "in-house" Calibration Transfer Standard would be to send the transducers and control console to King Nutronics in the specially designed exchange kit container. The set would be calibrated and promptly returned.

In the case where several calibrators are in use, an extra transducer and control console set can be used as an exchange kit. The extra set can replace a set requiring calibration, which in turn can be shipped to King Nutronics for calibration. This technique would allow operations to continue without down time for calibration.



Model 3703 Calibration Transfer Standard



Calibration Exchange Kit

Specifications:

General:

Ambient Temperature Range:

Operating Temperature	+10°C to + 40°C
Non-Operating Temperature	-40°C to +75°C
Humidity (Operating)	85% RH (Max.), 10°C to 40°C

Input Power:

Voltage	115 volts ac, 50/60 Hz
Current Drain (Maximum)	5.0 Amperes
Fuse:	
Main Power Circuits	-3AG, 2 Amperes
Stepper Motor	-3AG, 7 Amperes

Dimensions and Weight:

Length	44.2 Inches
Depth	25.0 Inches
Height	54.5 Inches
Weight	760 Pounds

Readout Display Units: FT-LB, IN-LB, IN-OZ, N-M, Kg-M, LB, OZ, Kg, GM, N

Interface Compatibility: IEEE-488 GPIB, RS-232

Performance:

Range:

Torque Testing (Motor Driven)	0-5000 FT-LBS
Torque Testing (Test Item Driven)	5000-20000 FT-LBS
Force Gauge Testing	0-500 LBS
Cable Tensiometer Testing	0-2400 LBS
Cable Tester Testing	0-5000 LBS

Accuracy:

Torque Testing (Motor Driven)	±0.5% I.V. or ±0.005 FT-LB (Whichever Is Greater)
Torque Testing (Test Item Driven)	±0.5% I.V. or ±5 FT-LBS (Whichever Is Greater)
Force Gauge Testing	±0.125% I.V. or ±0.005 LB (Whichever Is Greater)
Cable Tensiometer Testing	±2.5% I.V. or ±0.75 LB (Whichever Is Greater)
Cable Tester Testing	±0.75% I.V. or ±2.1LBS (Whichever Is Greater)

Resolution:

0 - 10	0.001
10 - 100	0.005
100 - 1000	0.05
1000 - 5000	0.5
5000 - 20000	1

Setability:

Force	±0.03% I.V. or ±0.001 LB (Whichever Is Greater)
Tension	±0.6% I.V. or ±.2 LB (Whichever Is Greater)
Cable Tension	±0.2% I.V. or ±.52 LB (Whichever Is Greater)
Torque (Bi-Directional)	±0.1% I.V. or ±0.001 FT-LB (Whichever Is Greater)

Functional Features:

Display: 40 Character Vacuum Florescent

Keyboard: 16 Position, Touch Sensitive

Manual Operation Hand Crank

Transducer Zero Voltage Adjust Automatic and Manual