Sturtevant Richmont®
Torque Measurement Systems

Torq-Tronics®
Digital Torque Tester

Owners Manual

Revision A 5/2004 P/N: 857433A

For Models: 1 Nm (10391), 6 Nm (10392), 12 Nm (10393), 34 Nm (10394), 80 (10195), 150 (10196), 250 (10197), 600 (10198)

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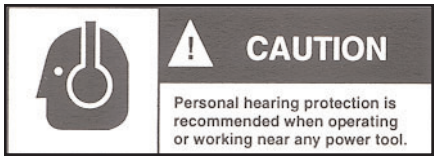
Safety Recommendations

For your safety and the safety of others, read and understand the safety recommendations before installing or operating the *Torq-Tronics*®.

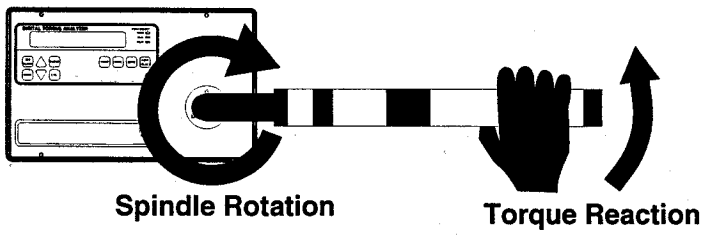
Torq-Tronics® Digital Torque Testers are designed and constructed to provide the user with a safe and reliable means of calibrating torque wrenches and power tools. Should a fault occur which impairs its function and/or compromises its safe use, immediately disconnect the unit from its power source and secure against unitended operation. Under no circumstances should repair be attempted by persons not qualified in the service of electronic instrumentation.

When testing tool torque, always wear protective equipment:

For additional information on eye and face protection, refer to Federal OSHA Regulations, 29CFR § 1910.133, Eye and Face Protection, and American National Standards Institute, ANSI Z87.1, Occupational and Educational Eye and Face Protection. Z87.1 is available from the American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036.



Hearing protection is recommended in high noise areas of 85 dBA or greater. The operation of other tools and equipment in the area, reflective surfaces, process noises and resonant structures can substantially contribute to, and increase the noise level in the area. Excessive air pressure above 90 PSIG or worn motor components can also increase sound level emitted by the tool. Proper hearing conservation measures, including annual audiograms and training in the use and fit of hearing protection devices may be necessary. For additional information on hearing protection, refer to CFR § 1910.95, Occupational Noise Exposure, and American National Standards Institute, ANSI S12.6, Hearing Protectors.

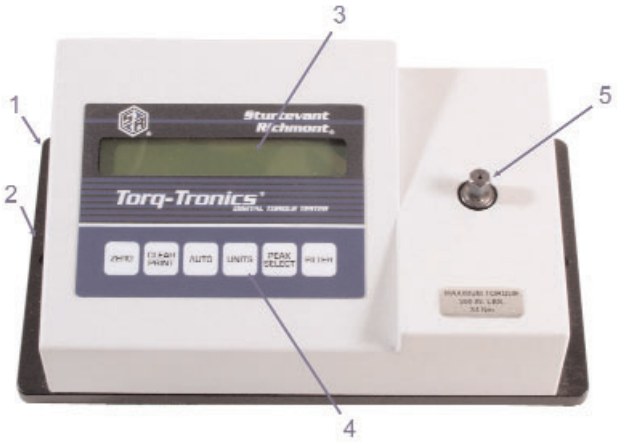


Torq-Tronics® Digital Torque Testers should be mounted and located such that inadvertent movement will not allow the unit to be dislodged, possibly causing personal injury or damage to the unit. Should the unit be dropped, it should be checked by someone qualified in the service of electronic instrumentation.

WARNING: Shock Hazard. Disconnect power to the unit before attempting to service. Any internal adjustments should be carried out only by skilled persons who are aware of the hazards of dealing with live circuitry. The cabinet which houses the circuitry provides protection against dust and falling dirt. This unit should be used only indoors. Do not use in explosive atmospheres.

WARNING: Shock Hazard. Damaged cords or plugs are dangerous, and should be repaired or replaced as necessary.

CAUTION: Tripping Hazard. Electrical cords and tool cables must be organized and located in such a manner as to reduce the likelihood of the user others of tripping or becoming entangled in electrical cords and cabled used with this product. Route electrical cord so that it is not subject to chafing, crushing, or severing.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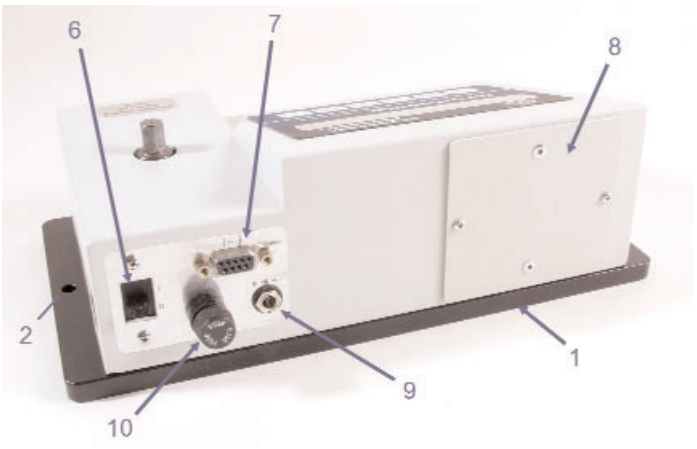
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150 FT. LBS.
203 Nm


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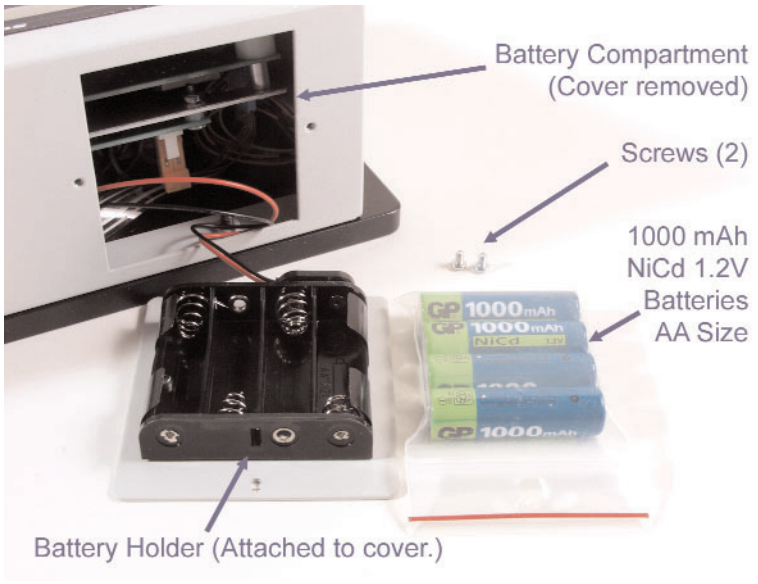

Meet Your *Torq-Tronics*®

1 Back Plate
2 Mounting Hole (2 or 4 locations, depending on capacity)
3 Backlit LCD Display
4 Keys
- Zero Key
- Clear/Print Key
- Auto Key
- Units Key
- Peak Select Key
- Filter Key

5 Transducer Drive
6 Power Switch
7 Serial Port
8 Battery Compartment Cover
9 6 VDC Power Input (from supplied 120 VAC Adapter)
10 Fuse

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Chapter 1 - Features

Back Plate
The Back Plate of your *Torq-Tronics*® unit provides primary structural strength for it and a means by which the unit may be installed.

Mounting Holes
The Mounting Holes in the Back Plate provide a means of securing the unit in its' installed location. The holes are designed for use with 3/8" (or metric equivalent) bolts, and it is important to use bolts in all holes when installing your *Torq-Tronics*®.

Backlit LCD Display
The 16-character Backlit LCD Display is your "information center" when operating your *Torq-Tronics*® unit. It provides such information as software version, mode of operation, units of measure, direction of torque, automatic or manual printing/display clearing status, and warning of low battery power. Note: To conserve battery power, backlight operates only when charger is connected.

Zero Key
The Zero Key is used to return the unit to zero when changing torque test direction, or to zero when drift occurs. It is also used during the calibration process. It is important not to press the Zero key when torque is applied to the transducer.

Clear/Print Key
The Clear/Print key performs two functions. When pressed, it sends the torque measurement on the display to the serial port for communication to a computer or printer, then it clears the display for the next torque measurement.

Auto Key
The Auto key is a toggle switch which activates and deactivates the automatic status of the Clear/Print function. When the automatic print/automatic clear function is active, an "A" will appear behind the measurement units on the LCD display. When the automatic print/automatic clear function is deactivated, the displayed measurement must be printed and cleared manually by pressing the Print/Clear key, and no "A" will be displayed.

Units Key
The Units key is used to page through the measurement units the tester offers. The measurement units available on each tester are given in the Specifications chapter of this manual. Each time this key is pressed, it pages to the next measurement unit available in the series.

Peak Select Key

The Peak Select key is used to select from among the four modes of operation: Track, Peak, Initial Peak, and Power Tool. When turned on, your *Torq-Tronics*® always boots into Track mode. Each time this key is pressed, it pages to the next mode of operation.

Track mode is used for calibration of the *Torq-Tronics*® unit. When the tester is in Track mode, "Tk" will be displayed at the far right of the LCD.

Peak mode is used for testing dial and beam torque wrenches. When the tester is in this mode, "PK" will be displayed at the far right side of the LCD.

Initial Peak mode is used for testing clicker-type torque wrenches and torque screwdrivers. This mode captures the torque at which the torque stopped rising due to activation of the torque-limiting mechanism inside. When the tester is in this mode, "IP" will be displayed at the far right of the LCD.

Power Tool mode is used for testing power tools. *Torq-Tronics*® is suitable for testing continuous drive and non-continuous drive power tools of all types except impact wrenches. Impact wrenches may not be tested with it; attempting to test impact wrenches on your *Torq-Tronics*® may damage the unit. In Power Tool mode filter selection is activated.

Filter Key

Filters are electronic devices which "clean up" the analog electrical signal coming from the torque transducer before the signal is measured and the measurement converted to torque. This filtering removes some of the top of the wave peak and the bottom of the wave trough in the signal from the transducer. There are five of these filters in the *Torq-Tronics*® tester, and they are numbered "0" through "4". The lower the filter number, the more of the peak and valley is discarded before the signal is sent on for processing. The Filter Key pages through the four available filters in sequence. More about filters may be found in the chapter on filters and power tool testing.

Transducer

The transducer is the device which uses Hooke's Law and Ohm's Law to convert applied torque into an electrical signal. The front of the transducer has either a male hex drive (on units of 300 inch-pound capacity or less) or a female square drive (units of greater than 300 inch-pounds capacity). It is the transducer to which the torque tool is connected for testing.

Battery Compartment Cover

Retains the rechargeable AA nickel cadmium batteries. This cover should only be removed to replace batteries.

Power Switch

The power switch is used to turn on the tester for use or turn it off when testing has been completed.

Fuse
Your *Torq-Tronics*® tester has a ½ ampere Buss fuse in the fuse holder.

Serial Port
The serial port is a 9-pin port for serial communications with either a computer or serial printer. Data is sent to the port for transmission when the display is cleared, whether automatically or manually.

6 VDC Power Input
The 6 VDC Power Input is provided for connection of the supplied 120 VAC to 6 VDC Adapter (240 VAC to 6 VDC in Europe) to the tester.

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Chapter 2 - Installing Your *Torq-Tronics®*

Mounting - Location Selection

There are several items that must be considered when selecting the location where your *Torq-Tronics®* will be mounted. These are:

Tool proximity. Do you want to test tools at or near their use location or do you want to bring the tools to a central location? Will you be using a computer and Torque Tool Manager (TTM) software with your *Torq-Tronics®*?

Solidity of mount. Your *Torq-Tronics®* unit must be secured to a solid support to function properly. If the tester can move when a torque tool is tested, the motion will degrade the accuracy of the torque measurement, and over time the motion may damage the unit or the support the unit is attached to. The selected mounting location must also be equal to or larger than the base plate of the tester - full support of the base plate is required to achieve the required rigidity. See the Safety Recommendations at the front of this manual.

Electricity source. Your *Torq-Tronics®* requires a source of electricity to power the unit and recharge the batteries. The backlight of the LCD will only work when the unit is plugged into the proper power source. If you will be using a PC running TTM with your unit, electric power will be required for it as well. The installation must be close to an appropriate power source. See the Safety Recommendations at the front of this manual.

Tester orientation. Units 34 Nm capacity and belows have been optimized for installation in the horizontal plane. Orienting the tester so the bottom of the faceplate faces the operator will make the tester easier to read and use. This orientation also minimizes the gravitational effect when the tool is engaged to the drive, enhancing accuracy. Higher capacity units are designed for either horizontal or vertical (as on a column or available stand) mounting.

Power/Communications access. Your *Torq-Tronics®* uses NiCd rechargeable batteries and a battery charger as electric power sources. The batteries will need to be replaced periodically. This requires removal and reinstallation of the battery plate cover on the side or rear of the *Torq-Tronics®* unit. This is also the location of the charger receptacle, serial port, and power switch. It is important that sufficient clearance be maintained around the unit that access and workspace for battery replacement and power/communications connections be available. Note: Do not use other types of batteries.

If power tools are to be tested, access to the air or electricity needed to drive them must be available, along with the space around the unit to maneuver them during testing. Connections to the power sources must be located such that the hoses or cables will not interfere with the tester operation.

Mounting to Selected Support

Once the installation location has been determined, the actual installation process can begin.

1. Place your *Torq-Tronics*® in the selected mounting location, supported as necessary to assure stability of the location and safety.

2. Mark the location of the mounting holes on the surface to which the tester is to be mounted.

3. Remove the *Torq-Tronics*® from the installation location, and drill or drill and tap mounting holes.

4. Your *Torq-Tronics*® may be mounted with bolts and nuts or with bolts into a drilled and tapped hole. Regardless of method, the *Torq-Tronics*® is designed to be mounted with 3/8" (or metric equivalent) diameter bolts. Bolts should be at least SAE Grade 5, with SAE Grade 8 preferred. Drill, and if necessary, tap the holes.

5. Place the *Torq-Tronics*® over the holes and install the bolts, and if necessary, nuts. Check to insure that the tester does not move after the fasteners have been installed.

Electrical Connection

1. The first step in providing power is installation of the four (4) AA NiCd batteries.
   a. Remove the two Phillips head screws holding the battery cover in place on the *Torq-Tronics*® unit. Use a #1 Phillips screwdriver.
   b. Gently remove the battery cover and attached battery pack from the *Torq-Tronics*® unit. Do not move the cover and battery pack any further from the unit than is necessary to install the batteries! The wires from the battery pack to the internal electronics are small and soldered inside. Placing excessive tension on them will break the wires and necessitate returning the unit for repair!
   c. Open the package containing the supplied batteries.
   d. Following the battery orientation shown inside the battery pack, install all four batteries into it. It is important that proper battery orientation be maintained!
   e. Gently push the wires connecting the battery pack to the internal electronics into the unit while replacing the battery cover back in its' original position.
   f. Reinstall the two Phillips head screws used to retain the battery cover in place. The screws should only be tightened snug.

2. The second step in providing power to your Torq-Tronics is connection to the AC power source.
   a. Unwrap the AC to DC Adapter supplied with your *Torq-Tronics*®.
   b. Plug the charger pin into the 6 VDC power input on the rear of the unit.
   c. Plug the other end of the charger into a properly wired 120 VAC (240 VAC in Europe) outlet.

Computer Communications (Optional)

If you will be using your *Torq-Tronics*® with a computer and TTM software or a serial printer, this is the time to establish communications.

1. Gently insert the male end of your 9-pin serial cable into the serial port on your *Torq-Tronics*® unit.
2. Thread the externally-threaded fasteners on either side of the cable terminal into the internally-threaded securing nuts on either side of the serial port. Tighten fasteners just enough to secure cable terminus in position.
3. Connect the other end of the serial cable to the serial port on your computer or serial printer.
4. Serial communications parameters are: 4800 baud, No parity, 8-bit, 1 stop bit.

Test Installation

The last step in the installation process is checking to insure the unit works as installed.

1. Testing Electrical Power Supply
   a. Move the power switch to the on position. If the batteries are properly installed and AC power is connected, the backlit LCD display will come on, a series of messages will be displayed, and the unit will finish in Track mode at zero torque value in English units of measurement. If the backlights on the LCD are not lit, it means the unit is not properly connected to an AC power source. Check power to the AC outlet, that the charger is firmly plugged into the outlet, and that the charger pin is fully inserted into its' receptacle in the *Torq-Tronics*® unit.
   b. Unplug the charger from the 120VAC (240 VAC in Europe) outlet. If the backlight on the LCD goes out but the characters remain displayed, the batteries have been properly installed. If the backlight goes out and the characters do not remain displayed, the batteries have either not been installed or have been improperly installed. To correct this, move the power switch to the off position, remove the battery pack cover, remove and properly reinstall the batteries, then reinstall the battery pack. Move the power switch to the on position and the characters will be displayed.
   c. Move the power switch to the off position and reconnect the charger to the 120 VAC (240 VAC in Europe) power outlet.
2. Testing communications (Optional)
   a. Computer Communications Test
      i. Activate terminal software.
      ii. Move the power switch on the *Torq-Tronics*® to the on position.
      iii. The message "Sturtevant Richmont" then "System 7 Ver 2.0" then "TORQTRONICS [Model]" will appear in the terminal software window if the Torq-Tronics is properly connected and the proper serial port is selected and properly configured. If these letters do not appear, check for proper cable connection, proper port selection, and proper port configuration. Serial communications specifications may be found in the Specifications section of this manual.

b. Serial Printer Test
   i. Move the power switch on the *Torq-Tronics*® unit to the on position.
   ii. Turn on the printer.
   iii. The message "Sturtevant Richmont" then "System 7 Ver 2.0" then "TORQTRONICS [Model]" will print if the printer is properly connected and the power is on. If this does not occur, check printer power, printer settings, and serial cable connections.

Chapter 3 - Testing Torque Wrenches & Manual Torque Screwdrivers

This section covers the testing of clicker-type torque wrenches and manual torque screwdrivers using your *Torq-Tronics*®. These tool types have a specified accuracy of ± 4% to ± 6% Indicated Value (I.V.) or less, and are suitable for testing on the *Torq-Tronics*®, which has an accuracy of ± 1% I.V. Tools of accuracy tighter than ± 4% I.V. can be tested, but not certified with this tester. This includes most dial- and beam-type torque wrenches. If you have a need to certify such tools, contact Sturtevant Richmont for assistance in selecting an appropriate torque measurement system.

This section assumes your *Torq-Tronics*® has been properly installed, and that any communications connections have been made. If these steps have not been performed, please perform them according to the instructions in the preceding chapter.

A clicker-type torque wrench will be used as the first example in this chapter. The procedure for testing a torque screwdriver is the same as that used for the clicker-type torque wrench.

Starting the *Torq-Tronics*®

1. Move the power switch to the ON position.
2. Allow the *Torq-Tronics*® to boot up. During this process, two messages will be displayed on the LCD.
   a. "System 7 Ver 2.0"
   b. "TORQTRONICS [Model #]"
3. After these two messages have been displayed and cleared, the tester will display its operating status on the LCD. This will consist of:
   a. A plus (+) or minus (-) sign in front of
   b. a torque value at or near zero, followed by
   c. the units of measure currently in use.
   d. There will then be one or two blanks, followed by
   e. "TK" to indicate the tester is in Track mode.
4. If the displayed torque value is not zero, press the Zero key to return the tester to zero value.
5. Press the Peak Select key twice to page from Track mode to Initial Peak mode. The last two characters on the display will change to "IP" when the tester has entered this mode.
6. If you wish the test results to automatically print and clear from the LCD within a few seconds of test completion, press the Auto key once. An "A" will be displayed immediately behind the units of measure. If you wish the torque measurement to be displayed until you wish it cleared, you need do nothing. Clearing each measurement from the display will require pressing the Clear/Print key after each display when in manual mode.

Preparing the Torque Wrench

Check that the torque wrench to be tested is of equal or lesser torque capacity than the tester. Under no circumstances should the *Torq-Tronics*® be used beyond its' rated capacity! Adjust the torque wrench to the desired torque level for testing.

If your *Torq-Tronics*® has a male hex drive; put a socket of the same size on the front of the torque wrench, so the transducer drive can be engaged by the tool. If an interchangeable head torque wrench is being tested, use a head with a hex opening equal to the size of the hex drive. If your tester has a square drive, engage the tool directly to the tester. Use a square drive adapter if needed.

Testing the torque wrench.

Grasp the torque wrench at its' load point, and apply slowly increasing force steadily until it clicks. Stop applying force immediately, and allow the torque wrench to reset. The measurement will be displayed on the LCD.

Testing a Dial or Beam Torque Wrench

1. Move the power switch to the ON position.
2. Allow the *Torq-Tronics*® to boot up. During this process, two messages will be displayed on the LCD.
   a. "System 7 Ver 2.0"
   b. "TORQTRONICS [Model #]"
3. After these two messages have been displayed and cleared, the tester will display its operating status on the LCD. This will consist of:
   a. A plus (+) or minus (-) sign in front of
   b. a torque value at or near zero, followed by
   c. the units of measure currently in use.
   d. There will then be one or two blanks, followed by
   e. "TK" to indicate the tester is in Track mode.
4. If the displayed torque value is not zero, press the Zero key to return the tester to zero value.
5. Press the Peak Select key twice to page from Track mode to Peak mode. The last two characters on the display will change to "Pk" when the tester has entered this mode.
6. If you wish the test results to automatically print and clear from the LCD within a few seconds of test completion, press the Auto key once. An "A" will be displayed immediately behind the units of measure. If you wish the torque measurement to be displayed until you wish it cleared, you need do nothing. Clearing each measurement from the display will require pressing the Clear/Print key after each display when in manual mode.

Testing the torque wrench.

Grasp the torque wrench at its' load point, and apply slowly increasing force steadily until it reaches the test point. Stop applying force immediately, and allow the torque wrench to return to zero. The measurement will be displayed on the LCD. Compare tool memory needle to tester reading.

Chapter 4 - Power Tool Testing Overview

Types of Power Tools

Power tool types may be broken down into two basic categories: continuous drive and non-continuous drive. Continuous drive tools are those that drive until a selected torque is reached. Clutch and stall tools are examples of continuous drive tools. Non-continuous drive tools are those where the power is not continuously applied. Examples of this type are impact wrenches and pulse tools.

Of the non-continuous drive tools, only pulse tools may be tested on your *Torq-Tronics*®. Impact tools are not to be tested on the *Torq-Tronics*® family of testers. Doing so will invalidate the tester warranty and probably damage the tester.

Automatic Shutoff Tools (Stall, Clutch, Continuous Drive)

All automatic shutoff tools use the joint for feedback to the shutoff mechanism. This means that the joint is part of the control loop which determines the shutoff point, and the final torque, achieved on the fastener by the tool. The tool affects the joint by tightening the fastener, which affects the tool by resisting further rotation, which affects the shutoff mechanism. This loop starts when the tool is activated while engaged with the fastener, and ends shortly after the shutoff mechanism activates.

The tool and joint do not stop interacting the instant the tool shuts off. All of the rotating components in the tool have momentum from the rotation. Once the power shuts off, these components (motor shaft, drivetrain components, chuck, and bit or socket) continue to interact with the fastener until all momentum is dissipated. This is one of the primary reasons that filters and joint simulators are used.

Non-Shutoff Power Tools (Pulse, Discontinuous Drive)

Non-shutoff or manual power tools continue to apply torque as long as power is present and the tool is activated. The torque actually transmitted to the fastener will not perpetually increase, even when the tool is activated for a long period of time. Once the fastener torque has increased to the maximum output of the tool, either the tool will stall, the clutch will slip, or the applied torque will simply stop moving the fastener because the torque is less than that already on it.

Pulse Tools - Special Considerations

A pulse tool is essentially an impact tool with a buffer between the hammer and the anvil. Due to the impacting pulses on the joint, these tools are typically joint sensitive. The actual torque transmitted to the joint is a function of the peak output of the tool and the joint rate

(hardness or softness). Within limits, the harder the joint, the higher will be the torque on the fastener at the same torque setting on the tool.

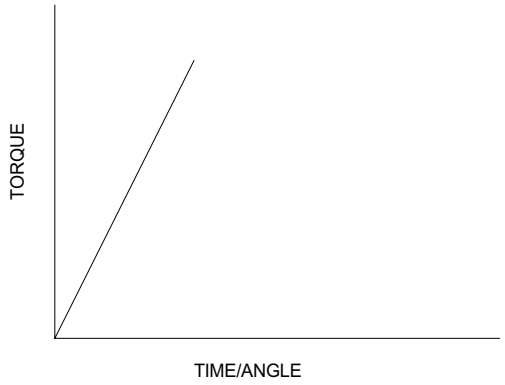
Pulse tool manufacturers use varying design approaches. Pulse tools of Japanese manufacture tend to differ in approach from those of American or European manufacture. In the chapter on Filters a general guide is given to filter selection for testing the various types of tools, including pulse tools.

Chapter 5 - Joint Simulators and Power Tool Testing

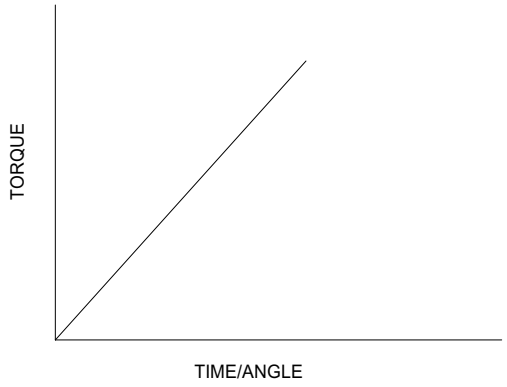
Joint Hardness

Joint hardness is the rate at which a joint develops clamping force as torque is applied to the fastener. Any given joint may be "hard", "soft", or somewhere in between. Note: Joint hardness is classified in accordance with the ISO 5393 standard.

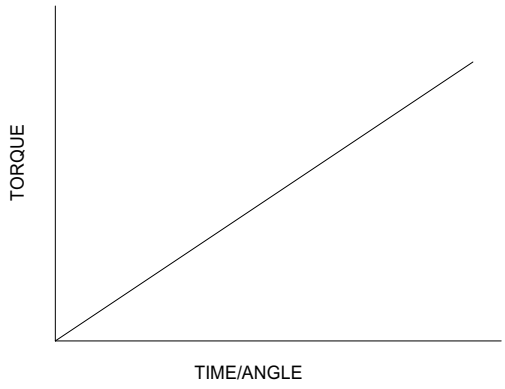
A "hard" joint is one which requires very little fastener rotation to develop the joint preload (clamping force) desired for the assembly. Stated another way, there are very few degrees of fastener rotation, and very little time, from the moment the fastener develops a small percentage (10%) of the fastener preload desired to the moment the fastener develops 100% of the desired preload.



This is depicted in the first diagram. In this diagram, the horizontal axis is time or rotation angle, and the vertical axis is the torque which results in clamping force. The very rapid rise in torque and clamping force over very little time is what defines a hard joint.



The next diagram is of a medium joint. Notice that the rise in torque and clamping force takes more time - fastener rotation - than it did in a hard joint. The angle of rotation is between 30º and 270º.



The third diagram is of a soft joint. Notice the slow rise in torque; it takes more time - and fastener rotation - to reach the same installation torque. The angle of fastener rotation is greater than 270º.

Joint Hardness and Power Tool Calibration

Almost all continuous drive power tools rely on the reaction of the joint to determine when to shut off. The tool affects the joint by tightening the fastener. The joint affects the tool by varying torque feedback. The feedback is as much a part of the torque control as is the clutch or valve that triggers the tool shutoff.

If a power tool is tested or calibrated on a joint that is feeding back information significantly different from the feedback the power tool will receive when used on the assembly line, the results may be markedly different from each other. The tester will show a torque output of one level, but a test of the fastener torque on the assembly after the tool is used will show a different torque. It is for this reason that rundown fixtures were developed, and are used in most power tool calibrations.

Rundown Fixtures

A rundown fixture is a device intended for use in power tool torque testing on torque transducers. It is designed to emulate the reaction of a wide range of joint hardnesses. By doing this, it permits the user to obtain test results that are more predictive of actual tool performance on the line.

Rundown fixtures typically contain:

- A means of being attached to the torque transducer drive.
- A set of Belleville washers (or a spring) which can be configured to emulate the joint response. Only joint simulators with Belleville washers are adjustable for joint rate simulation. Joint simulators with springs have a joint rate fixed by the spring rate, and can only be adjusted by spring replacement.
- A means of compressing the washers while transmitting the applied torque to the torque transducer.

If you encounter a problem with testing continuous drive power tools and changing the filter selection does not solve it, installing a rundown fixture to the tester transducer drive and configuring it to match the joint rate is probably needed.

Chapter 6 - Filters

Purpose

The electronic filters in the *Torq-Tronics*® Digital Torque Testers perform two key functions: preventing electronic noise from causing inaccurate torque readings, and assisting in the discrimination of the true applied torque signal from the extraneous signals generated by power tool mechanisms.

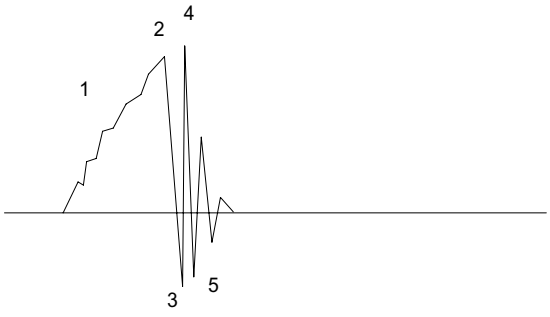
The first of these filtering functions is straightforward. These testers are often used in electronically "noisy" environments. Lights, electric motors, and power lines are just some of the sources of electronic noise present in factories and laboratories. The wires in the *Torq-Tronics*® can pick up this noise, and send it to the torque analysis circuitry. Part of the purpose of the filters is to eliminate this problem.

The second purpose of the filters is to enable the user to separate the mechanical actions of the power tool which perform the work of applying torque from those actions which result in signals but which do not actually apply torque to the fastener.

Filtering Concept

In Chapter 5, concept drawings were used to explain the relationship of time and degrees of rotation to the applied torque and the clamping force it generates. For the sake of clarity, these drawings were simplified to straight lines. The next drawing is more typical of the actual performance of a power tool in use, as shown on an oscilloscope.

In this drawing, time is the horizontal axis, and voltage is the vertical axis. The horizontal line is the starting voltage from which torque is measured. The horizontal line = no torque. The erratic line is the voltage coming from torque transducer, unfiltered.



In this drawing, the power tool has been used to run down a single fastener. The tool shut off when it reached the shutoff torque.

The slope of the line (#1) during the rundown of the fastener is not a smooth line; the rundown is not as smooth as it appears to the human eye. The acceleration and deceleration of the torque application rate is the result of the inevitable imperfections in the fasteners, the power tool, the joint components, and how they interact during the rundown phase of the power tool use.

The tool actually shut off at the peak labeled point #2. Once the power driving the bit was shut off, regardless of the means, the bit rebounded off the drive of the fastener, and created a backlash through the drive mechanism of the tool. This created torque in the opposite direction, as displayed by the line running from point #2 to point #3. The components of the tool drive continued to rebound off each other, as shown in points #4, #5, and the rest of the line to the right of them, until it stabilized at zero.

The graph discloses a number of peaks during fastener rundown, as well as those occurring at and after tool shutoff. This type of action - not identical, but similar - occurs with all non-impacting power tool types on all joints. There are many variables involved: the power tool type, the individual tool, the fasteners, the joint rate, the tool power supply, rundown speed, the tool's shutoff mechanism, and the broad variety of the interactions between them. These sources of mechanical "noise" create the electronic noise that must be eliminated to determine what will be the actual applied torque on the fastener.

It is the filter, augmenting the joint rate emulation of the rundown fixture, which permits effective off-line calibration with confidence the results on the tester will correlate with the results in the assembly process.

There are five (5) filters provided on each *Torq-Tronics*®. The filters are numbered 0, 1, 2, 3, and 4. Each filter provides a different amount of noise reduction, with Filter 0 having the most filtering and Filter 4 the least.

Since there are only five filters, and there are an extraordinary variety of joints and power tools on which the tester might be used (and more power tools and applications coming out every year), learning to balance the joint simulator and the filters is a key to assuring a successful power tool testing program.

The following list is provided as a guide to filter selection in power tool testing. It is a guide intended for use as a start point. The actual filter that provides the most accurate test results will vary by power tool type, configuration, and joint, and will have to be determined by experimentation.

Filter	**Hz**	**Suggested Application (Start Point Only)**
0	104	Clutch-type tools having dramatic clutch bounce.
1	210	ISO 5393, clutch- or stall--type tools - recommended filter
2	560	Pulse tools of Japanese design and manufacture
3	1206	Pulse tools of American/European design and manufacture
4	1900	Pulse tools of American/European design and manufacture

Filter values above are +/- 5%.

Experiment to find the filter that produces results that correlate with post-assembly joint audit results. Usually one of the filters will work. If not, a rundown fixture is likely needed.

Chapter 7 - Testing Power Tools

Power tools of 10 inch-pound capacity or less should not be tested using a rundown fixure. Tools ranging upwards from there may require the use of a rundown fixture as well as the filters on the *Torq-Tronics*®. This procedure assumes the tester has been installed per the instructions in Chapter 2 of this manual. The procedure given below assumes exact measurement of the individual joint/tool combination is desired. This procedure may be modified as needed for a correlative approach.

Procedure

1) Measure Joint
   a) Perform a static audit of the joint the tool is used on.
   b) Record the data. It will be used as comparison data for the results obtained from the tester.

2) Start the *Torq-Tronics*® tester.
   a) Use the Power Switch to turn on the tester, and allow it to boot up.
   b) Allow the tester to warm up for 10 minutes.
   c) If a rundown fixture will be used, configure it for the test and install it on the transducer hex drive.

3) Use the Units key to select the units of measure to be used.

4) Use the Mode key to select the Power Tool mode (Pt). The tester will automatically select Filter 0 as the default.

5) Use the Filter key to select the filter to be used during the test. If the correct filter is not known, use the table on the preceeding page as a guide to a good start point. To change the filter, simply press the filter key and page through them until the desired filter is displayed. Stop pressing the key and the tester will revert to the Power Tool test mode after a couple of seconds.

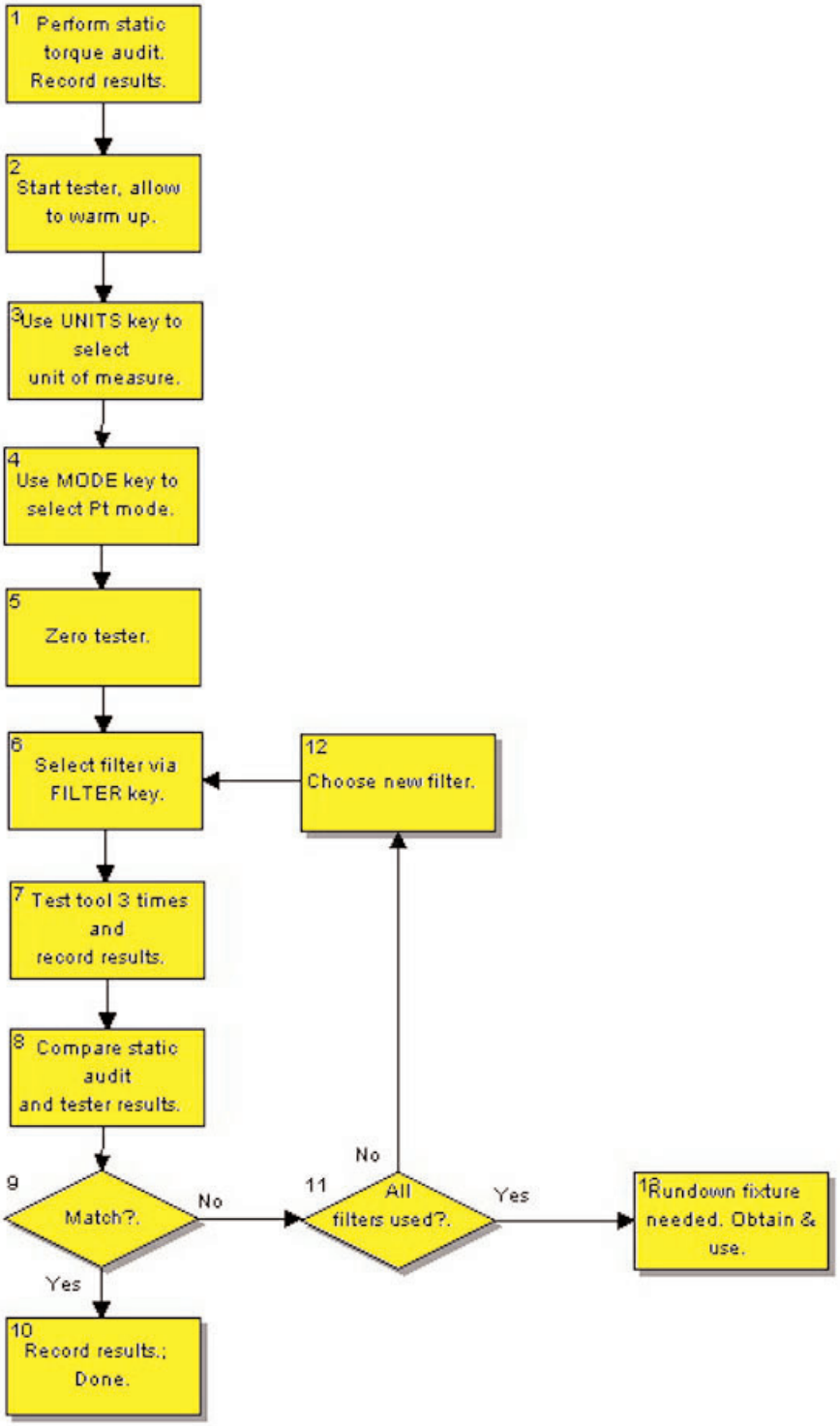
6) Press the Zero key to assure the tester is zeroed prior to the test.

7) Test the tool.
   a) Test power tool; directly if no rundown fixture is used, or by running down the fastener if one is used.
   b) Record the torque displayed on the LCD of the tester.
      1) Loosen the fastener back to its' original position if a rundown fixture is used.
   d) Press the Clear/Print key to clear the display.
   e) Repeat the above four steps two more times.

8) Compare the results to the actual applied torque obtained from the joint.
   a) If the results agree with the actual output of the tool on the joint, record the information on the rundown fixture configuration and filter used for this test for future use with this tool. Testing complete.
   b) If the results do not agree with the actual output of the tool on the joint, and all filters have not yet been tried, another filter may be better to use with this combination of tool and joint. Go to step 9.
   c) If the results do not agree with the actual output of the tool on the joint, and all five filters have been tried, then a rundown fixture (if one was not used) or an adjustment to the rundown fixture (if one was used) will be needed.
      i) Use the Power Switch to turn off the tester.
      ii) Remove the rundown fixture from the tester.
      iii) Adjust the rundown fixture to emulate a harder or softer joint.
      iv) Return to Step 3 of this procedure.

9) If the test results do not match the tool output, and all four filters have not yet been tried, it may be that the rundown fixture is correct but a different filter may be needed.
   a) Press the Filter button on the *Torq-Tronics*® tester to change to the next filter.
   b) Repeat steps 6, 7, and 8 of this procedure.

Power Tool Test Process Diagram
No Rundown Fixture Used



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Chapter 8 - Calibration

The calibration procedure for each model differs primarily in the arm and weight combination required to reach the calibration points for the model's torque capacity. Each procedure requires the use of:

* A computer equipped with a serial port and terminal software.
* A serial cable.
* Calibration weights, drive squares, arms, and platforms for the model to be tested.
* Refer to the "Calibration Table - *Torq-Tronics*® Models" at the end of this chapter.

Calibration Procedure

1) Turn on the *Torq-Tronics*® unit. Allow it to warm up for one (1) hour in Track mode.

2) Connect *Torq-Tronics*® unit to computer via serial cable.

3) Start terminal software.

4) For a summary of the calibration commands, type **:CM** into the terminal software, then press the "Enter" key.

5) Press the ZERO key on the *Torq-Tronics*® unit, then type **:CM2** into the terminal software and press the Enter key. Observe acknowledgement of calibration zero.

6) Obtain the proper calibration arm. The correct arm can be found in the "Calibration Table -*Torq-Tronics*® Models" at the end of this chapter.

7) Make certain the calibration arm is properly counterbalanced.

8) Attach the drive square of the calibration arm to the drive of the tester in the clockwise direction, and press the Zero key.

9) Hang the weight platform (hook) and the full-scale weights (100%) (found in the "Calibration Table - *Torq-Tronics*® Models") on the calibration arm - gently, and imparting as little motion to the weights as possible. Wait until the weights have completely stopped moving, then remove the full-scale load.

10) Wait one minute, then press the ZERO key on the tester.

11) Repeat steps 9 and 10 two more times, then proceed to step 12.

12) Hang the 1st calibration point (10%) weights, as found in the "Calibration Table - *Torq-Tronics*® Models", on the arm, gently. Wait for the arm to completely stop moving, then enter **:CM1** into the terminal software and press the Enter key. Observe acknowledgement of the 10% clockwise calibration point.

13) Again hang the weight platform (hook) and the full-scale weights (100%) (found in the "Calibration Table - *Torq-Tronics*® Models") on the calibration arm - gently, and imparting as little motion to the weights as possible. Wait for the arm to completely stop moving, then enter **:CM0** into the terminal software and press the Enter key. Observe acknowledgement of the 100% clockwise calibration point.

14) Remove weights and reverse calibration arm to the counter-clockwise direction, and press the Zero key.

15) Hang weight platform and full-scale (100% load as found in the "Calibration Table - *Torq-Tronics*® Models") load on the arm, gently. Wait until the arm has completely stopped moving, then remove the weights and platform.

16) Wait one minute, then press the ZERO button on the tester.

17) Repeat steps 14, 15, and 16 two more times, then proceed to step 18.

18) Hang weight platform and 10% weights on the calibration arm, gently. Wait until the arm has completely stopped moving.

19) Type **:CM3** into the terminal program and press the Enter key. Observe acknowledgement of calibration 10% counter-clockwise.

20) Hang weight platform and 10% weights on the calibration arm, gently. Wait until the arm has completely stopped moving.

21) Type **:CM4** into the terminal program and press the Enter key. Observe acknowledgement of calibration 100% counter-clockwise.

22) To save calibration, type **:CM5** into the terminal program and press the Enter key. Observe acknowledgement of calibration save.

Calibration Verification Procedure

1) Disconnect the RS-232 serial cable from the tester.

2) Reverse calibration arm from counter-clockwise direction to clockwise direction, and press the Zero key.

3) Hang weight platform and full-scale (100% load as found in the "Calibration Table - *Torq-Tronics*® Models") load on the arm, gently. Wait until the arm has completely stopped moving, then remove the weights and platform.

4) Wait one minute, then press the ZERO button on the tester.

5) Hang weight platform and 10% weights on the calibration arm, gently. Wait until the arm has completely stopped moving.

6) The torque displayed on the LCD's should be within the accuracy tolerance for the 10% calibration point for the unit.

7) Repeat steps 5 and 6 with the 20%, 50%, 80%, and 100% loads as specified in the "Calibration Table - *Torq-Tronics*® Models" at the end of this chapter.

8) Remove and reverse calibration arm to the counter-clockwise direction, and press the Zero key.

9) Repeat steps 3, 4 and 5 in the counter-clockwise direction.

Model & Range	Calibration Points	Percent of Capacity	Calibration Arm Length	Weight (Lbs.) (Inc. Platform)
1 Nm/10 in.lbs.	1 in. lb.	10	4"	0.25
	2 in. lbs.	20		0.50
	5 in. lbs.	50		1.25
	8 in .lbs.	80		2.00
	10 in. lbs.	100		2.50
6 Nm/50 in. lbs.	5 in. lbs.	10	10"	0.50
	10 in .lbs.	20		1.00
	25 in. lbs.	50		2.50
	40 in. lbs.	80		4.00
	50 in. lbs.	100		5.00
12 Nm/100 in.lbs.	10 in. lbs.	10	10"	1.00
	20 in. lbs.	20		2.00
	50 in. lbs.	50		5.00
	80 in. lbs	80		8.00
	100 in.lbs.	100		10.00
34 Nm/300 in.lbs.	30 in. lbs.	10	10"	3.00
	60 in.lbs.	20		6.00
	150 in.lbs.	50		15.00
	240 in. lbs.	80		24.00
	300 in. lbs.	100		30.00
80 ft. lbs	8 ft. lbs.	10	10"	9.60
	16 ft. lbs.	20		19.20
	40 ft. lbs.	50		48.00
	64 ft. lbs.	80		76.80
	80 ft. lbs	100		96.00
150 ft. lbs.	15 ft. lbs.	10	48"	3.75
	30 ft. lbs.	20		7.50
	75 ft. lbs.	50		18.75
	120 ft. lbs.	80		30.00
	150 ft. lbs.	100		37.50
250 ft. lbs.	25 ft. lbs.	10	48"	6.25
	50 ft. lbs.	20		12.50
	125 ft. lbs.	50		31.25
	200 ft. lbs.	80		50.00
	250 ft. lbs.	100		62.50
600 ft. lbs.	60 ft. lbs.	10	48 "	15.00
	120 ft. lbs.	20		30.00
	300 ft. lbs.	50		75.00
	480 ft. lbs.	80		120.00
	600 ft. lbs.	100		150.00

Chapter 9 - Frequently Asked Questions

Can *Torq-Tronics*® be used to test dial or beam-type torque wrenches?

Yes, but not to calibrate them. There is a critical 4:1 ratio that must be maintained or exceeded when calibrating torque wrenches and torque screwdrivers. The tester must be at least four times as accurate as the torque wrench or torque screwdriver to be calibrated with it. Since *Torq-Tronics*® has an accuracy of ± 1% Indicated Value, it should only be used to calibrate tools of ± 4% I.V. accuracy or less.

If you have (or acquire) dial or beam-type torque wrenches and wish to calibrate them, look at the S/R System 4/5 Digital Torque Testers. They provide excellent platforms for testing all types of torque tools.

What is Torque Tool Manager?

Torque Tool Manager is software designed by Sturtevant Richmont to enable owners of our various digital torque testers to immediately and economically create a torque calibration system meeting all ISO and QS-9000 requirements. This software runs on any PC running Windows 3.1 or later, and with the addition of a serial cable:

* Create a database containing the make, model, serial number, test procedure, and calibration interval for each torque tool the user owns.

* Store the N.I.S.T. traceability numbers for the tester and each transducer used with the tester.

* Immediately access the record for each tool, start a new calibration, feed the data directly from the tester to the software, record the name of the Inspector, and date of calibration, then generate and ISO and QS-acceptable certification with one click of the mouse button.

* Save the record of calibration electronically for proof of performance.

Those owners who seek to attain compliance with ISO or QS 9000 requirements in their calibration of torque tools find this software quite worthwhile.

Is the backlight on the *Torq-Tronics*® display adjustable?

There is no adjustment for brightness or contrast on the display. The display operates with no backlight when the unit is used without AC power supplied. The purpose of this is to conserve battery power for maximum utility when used as a portable tester. The backlight is accessible, at only one brightness level, when AC power is used.

How often should *Torq-Tronics*® be calibrated?

At least annually, more often if subjected to heavy use. Immediately if damaged or over-torqued. Your experience with the tester will determine whether it should be calibrated more frequently or less frequently.

Specifications

The specifications contained herein are applicable solely to the models listed on the front cover and having Version 2.0 software. Software version is displayed on unit startup.

Specifications subject to change without notice.

General

Characteristic	Specification
Accuracy	+/- 1% Indicated Value
Accuracy Range	10% - 100% Capacity
Accuracy Direction	Bi-Directional, Clockwise and Counter-Clockwise
Modes	Track, Peak, Initial Peak, Power Tool
Display	3/4" High, Backlit, 16-Character LCD
Controls	Six (6) button keypad: Zero, Clear/Print, Auto, Units, Peak Select, Filter
Filter	Five (5) user-selectable cutoff frequencies in Peak mode.
Communication	RS-232C Serial Port, 9-Pin. Baud Rate 4800, Stop Bits 1, Parity None
Voltage	120 VAC
Charger	Trickle charger, standard.
Batteries	Four (4) each NiCd, 1000mA (max.) 1.5 VDC
Battery Life	Five (5) hours
Full Charge Time	Twenty (20) hours with supplied 120 VAC to 6 VDC Adapter.

Range and Drive Sizes

Model	Range	Drive Size
1 Nm	1-10 in.-lbs./1.13-11.3 dNm	1/4" Male Hex
6 Nm	5-50 in.-lbs./5.65-56.5 dNm	1/4" Male Hex
12 Nm	10-100 in.-lbs./1.13-11.3 Nm	3/8" Male Hex
34 Nm	30-300 in.-lbs./3.39-33.9 Nm	3/8" Male Hex
80	8-80 ft. lbs/10.8-108 Nm	.5” Female Square
150	15-150 ft. lbs./20.3-203 Nm	.5” Female Square
250	25-250 Ft. Lbs/33.9-339 Nm	.75” Female Square
600	60-600 ft. lbs./81.3-813 Nm	.75” Female Square

* 3/8” Female Square Adapter included. ** 1/2” Female Square Adapter included.

Units of Measure

Model	Units of Measure
1Nm	In-Oz, In-lb, cNm, dNm, Nm
6Nm	In-Oz, In-lb, dNm, Nm
12Nm	In-lb, Ft-lb, dNm, Nm
34Nm	In-lb, Ft-lb, Nm
80	In-lb, Ft-lb, Nm, kgf-cm
150	In-lb, Ft-lb, Nm, kgf-cm
250	In-lb, Ft-lb, Nm, kgf-cm
600	In-lb, Ft-lb, Nm, kgf-cm

Options/Accessories

Part No.	Model	Description
10187	240 VAC Adapt	240 VAC to 6 VDC Adapter
10349	RDF 1Nm	Rundown Fixture, 1 Nm capacity, 1/4” F hex
10350	RDF 3Nm	Rundown Fixture, 3 Nm capacity, 1/4” F hex
10351	RDF 6Nm	Rundown Fixture, 6 Nm capacity, 1/4” F hex
10352	RDF 17Nm	Rundown Fixture, 17 Nm capacity, 3/8” F hex
10353	RDF 34Nm	Rundown Fixture, 34 Nm capacity, 3/8” F hex
10354	RDF 34Nm	Rundown Fixture, 34 Nm capacity, 1/2” M hex
10355	RDF 68Nm	Rundown Fixture, 68 Nm capacity, 1/2” M hex
10356	RDF 109Nm	Rundown Fixture, 109 Nm capacity, 1/2” M hex
10357	RDF 204Nm	Rundown Fixture, 204 Nm capacity, 1/2” M hex
10358	RDF 339Nm	Rundown Fixture, 339 Nm capacity, 3/4” M hex
870776	Adapter 1/4"F	Adapter, 1/4"F square to 3/8"M square
870777	Adapter 3/8"F	Adapter, 3/8"F square to 1/2"M square
870778	Adapter 1/2"F	Adapter, 1/2"F square to 3/4"M square
21101	Batt AA	Batteries, NiCD, "AA" size, 1000mA
10309	TTM	Torque Tool Manager software
811006	CA 2.5	Calibration Arm (wheel), 2.5”
811017	CA 4	Calibration Arm (wheel), 4”
10090	CA-10 1/4	Calibration Arm, 10”, 1/4” Female hex drive
10091	CA-10 3/8	Calibration Arm, 10”, 3/8” female hex drive
10298	CA-48 1/2	Calibration Arm, 48”, 1/2 M square drive
10267	Platform 4oz	Weight Platform, 4 oz.
10269	Platform, 8oz	Weight Platform, 8 oz.
10270	Platform, 1 lb.	Weight Platform, 1 lb.
10271	Platform, 5 lb	Weight Platform, 5 lb., 27” length
10277	Weight, 4 oz	Slotted Weight, 4 oz.
10278	Weight, 8 oz	Slotted Weight, 8 oz.
10279	Weight, 1 lb	Slotted Weight, 1 lb.
10280	Weight, 2 lb	Slotted Weight, 2 lb.
10281	Weight, 5 lb	Slotted Weight, 5 lb.
10282	Weight, 10 lb	Slotted Weight, 10 lb.
10283	Weight, 20 lb	Slotted Weight, 20 lb.
10284	Weight, 50 lb	Slotted Weight, 50 lb.

Note: Quick battery chargers for the batteries used in *Torq-Tronics*® are available through Radio Shack and other electroncis distributors.