

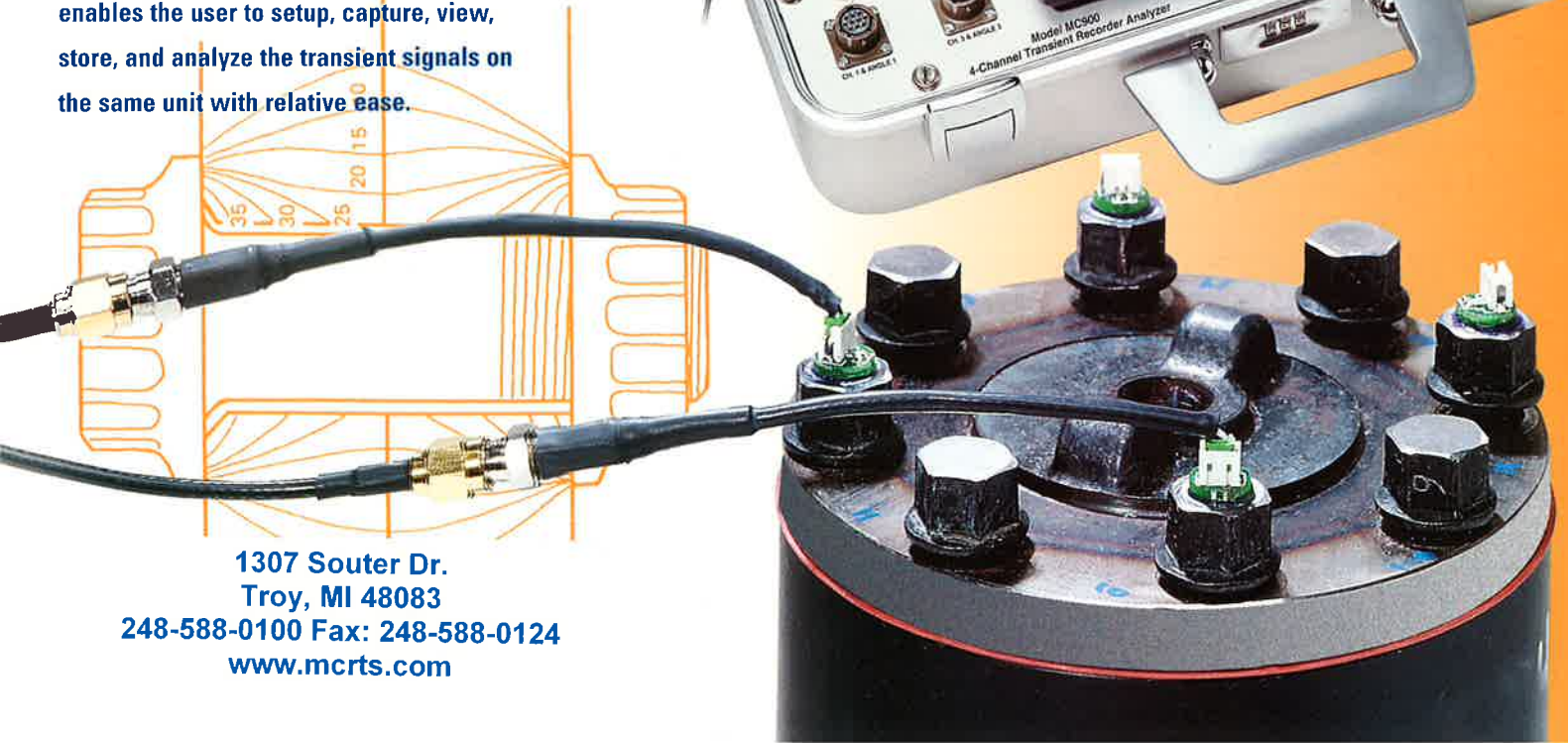
# MICROCONTROL INC.

Real Time Systems

## MC900 Transient Recorder Analyzer

The New

MC900 Transient Recorder Analyzer is the most complete system for fastener performance recording and analysis. Combination of the standard MC900, which can measure signals from a variety of sensors (including torque, angle, load cell, pressure) with its optional ultrasonic tension measurement system, provide a powerful tool for fastener engineers. It is a valuable tool in studying threaded fastener joint designs or dynamic analysis of nut-runner operations on the plant floor or laboratory environment. It can measure torque, tension, elongation and angle of rotation of a threaded fastener in an actual joint without altering any joint characteristics. With use of the patented, low cost "Glue On" Ultrasonic Tension Sensor (UTensor™), the tension or elongation on a fastener can be measured dynamically or statically. Its powerful hardware and Windows software enables the user to setup, capture, view, store, and analyze the transient signals on the same unit with relative ease.



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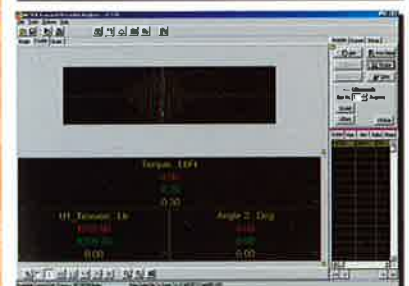
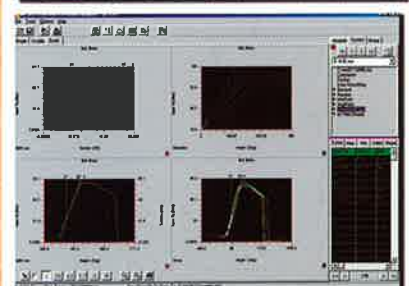
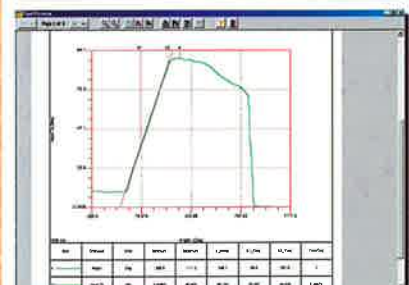
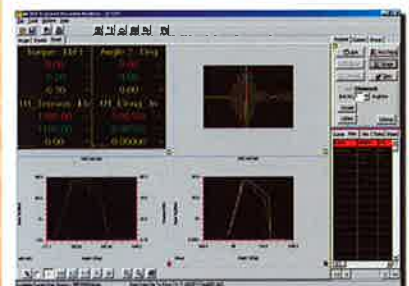
[www.mcrts.com](http://www.mcrts.com)



## Standard MC900 Specification

- ✓ Micro computer-based data acquisition
- ✓ Connection to PC through standard parallel port
- ✓ Aluminum case for portable model (13" x 18" x 6", weight 18 lbs. including computer)
- ✓ High impact plastic for desktop model (14" x 21" x 7", weight 12 lbs.)
- ✓ **4 Strain gage input channels (expandable to 8 channels)**
  - Separate software-selectable excitation voltages on each channel (2.5, 5, 7.5 and 10 volts)
  - Input range 1mv/v to 4 mv/v
  - 4 Software-selectable shunt cal resistors for automatic calibration (2 internal and 2 external)
  - Automatic software-controlled gain and offset adjustments
  - Bendix connectors for power and signal on each channel
  - Banana jack connectors for external shunt cal resistors
  - Sensor resistance measurement on each channel
- ✓ **4 High-level analog input channels**
  - Signal generator on each channel for automatic calibration (+/-2 to +/-10 volts)
  - Automatic software-controlled gain and offset correction
  - BNC connector
- ✓ **4 Programmable hardware low pass filters**
  - Precision 8 pole filter on each channel (surpassing unwanted noise)
  - Pick capture on each channel (up to 500 kHz pulse, ideal for pulse tools)
- ✓ **4 Quadrature encoded input channels (angle or displacement)**
  - Software-selectable resolution on each channel
  - Provides degrees and direction of rotation
  - High noise immunity Schmitt trigger inputs, digital noise filter
  - + 5 Volt supply provided for encoder
  - Can capture up to 1 billion counts
- ✓ **4 Digital input and 4 digital output channels**
  - DB15 connector
  - Remote triggering or external arming
  - Digital output can be used for motor control or shutoff boxes

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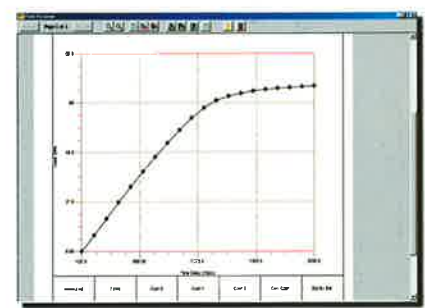


## Ultrasonic Option Specifications

- ✓ Patented ultrasonic technology\* manufactured under licenses from NASA
- ✓ Simultaneous ultrasonic measurement from 4 channels with other standard channels
- ✓ Each channel can be programmed as Pitch Catch, Pulse Echo, and Multiple Echo
- ✓ Pitch Catch can be used for longer bolts or bending bolts
- ✓ Multiple Echo can be used for shorter bolts to increase resolution
- ✓ 2 Tuning filters are available to accommodate different ultrasonic transducers
- ✓ Programmable tone burst frequency (optimize for the transducer)
- ✓ Programmable number of cycles in tone burst
- ✓ Reference echo for each bolt is saved on the hard disk
- ✓ Reference echo is displayed in conjunction with current echo so the detection point (zero crossing) can be visually verified
- ✓ Automatic or manual calibration with a known load (tensile machine or a load cell) versus "time of flight"
- ✓ Calibration averaging from few bolts to produce a master calibration curve
- ✓ Load can be determined in linear and nonlinear (yielded) area of bolt
- ✓ Calibration of temperature variation verses elongation
- ✓ Optional magnetic temperature sensor
- ✓ Calibration block for magnetic sensors
- ✓ ID recognition for smart sensors
- ✓ No need to transfer the data to another machine
- ✓ All the analyses and plots can be made in the same unit
- ✓ Can be used with magnetic or "glue on" transducers (UTensor™)



The MC900 easily accommodates advances in PC technology. When upgrading the laptop PC, simply install the software and plug it's printer port into the MC900 Transient Recorder Analyzer.



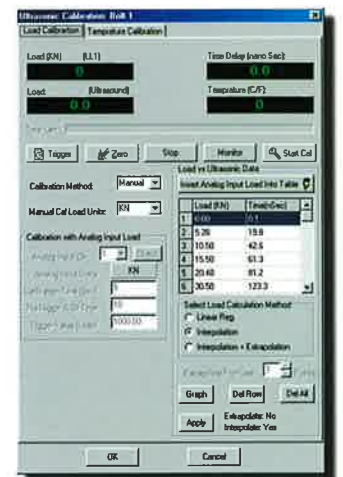
Plot of time delay vs. tension

## MC911 Software Specifications

- ✓ Windows-based software
- ✓ Up to 4 individual graphs on each tabbed graph sheet
- ✓ Unlimited number of sample files to overlay
- ✓ Statistical analysis of the picked points up to 10000 files
- ✓ Automatic or manual calibration
- ✓ Saving and retrieval of individual calibration files
- ✓ Real time graphs or large alphanumeric display
- ✓ Time-based or angle-based data collection
- ✓ Zoom and panning capability on graphs
- ✓ Lines, slopes, delta, drive-strip, yield detection on any graph
- ✓ Navigational keys for instantaneous viewing of data files
- ✓ Unlimited recording time (limited by memory size)
- ✓ I/O control for shutoff boxes
- ✓ Automatic RPM computation on any angle channel
- ✓ Cross plotting of torque, tension, angle or RPM
- ✓ Easy setup for each graph
- ✓ Easy setup menus for calibration, graph, and statistical analysis
- ✓ Optional friction analysis software
- ✓ Print preview
- ✓ Data or statistics text files for export



Calibration screen for standard strain gage



Calibration screen for ultrasonic

\* Patent No. US5771204 and US5841032



### Ultrasonic Accessories:

- ✓ 10 UTensor sensors
- ✓ 2 Wire assemblies
- ✓ Sensor adhesive
- ✓ Sensor remover
- ✓ Sensor cleaner
- ✓ Cotton swabs for cleaning
- ✓ Plastic case



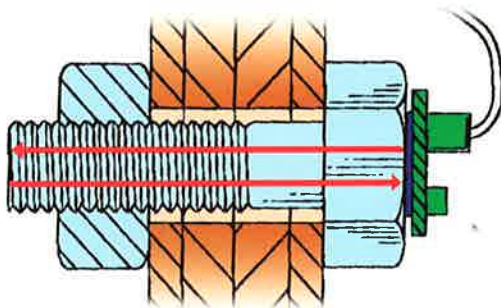
Patented sensor design allows for convenient removal and reuse.

### UTensor™ (Ultrasonic Tension Sensor) Specifications

- ✓ Low cost "glue on", reuseable ultrasonic tension sensor (Patent Pending)
- ✓ Multiple use when a weak adhesive is utilized
- ✓ Can be removed from head of the bolt with use of shear force
- ✓ Dynamic reading of tension while bolt is tightening
- ✓ Optional temperature sensor right on the sensor (faster response time, same wiring)
- ✓ Connection through a low-height detachable connector
- ✓ No reattachment error in comparison with magnetic sensors
- ✓ High precision
- ✓ The fastener can be non-magnetic



UTensor™ shown actual size



Desktop version of MC900 employs customer-supplied desktop PC.

### Theory of Ultrasonic Tension Measurement

An ultrasonic transducer is placed against one end of the bolt. MC900 delivers a voltage pulse to the transducer, which emits a brief burst of ultrasound (several cycles). This burst passes down the bolt, echoes off the far end, and returns to the transducer. MC900 measures very precisely the "time of flight", the amount of the time required for this burst of sound to make its round trip in the bolt. As the bolt is tightened, the time of flight increases for two reasons:

1. The bolt stretches as it is tightened, so the path length increases.
2. The average velocity of the sound within the bolt decreases because the average stress level has increased.

Both of these changes are proportional to tension in the fastener.

