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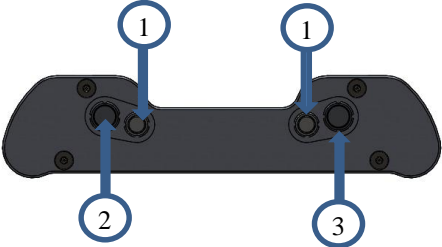
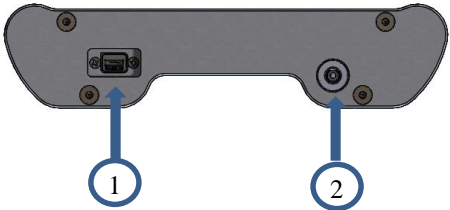
The 100th Year Anniversary of the Torque Wrench is just around the corner and as we celebrate this ingenious mechanical instrument, another ground breaking achievement in tools and technology for assuring bolt integrity is just being launched.

The $\Delta\delta$ (Delta-Sigma) Instrument from Resonic Instruments is the result of 40+ years of practical & theoretical development, in combination with extensive hands-on experience in the field of ultrasonic fastener measurement. The $\Delta\delta$ Instrument has been developed, designed and tested by the worlds most experienced bolting Engineers for use by anybody concerned with achieving and maintaining a constant and optimised bolt elongation, ensuring that fasteners behaves as expected, maximising their service life time.

The $\Delta\delta$ instrument is the first and only instrument on the market which uses new display & smart technology in the form of multiple algorithmic expressions, combined with combinatorics to analyse and return secure, integral fastener data on a modern touch screen interface.

The Delta-Sigma instrument is not a converted thickness gauge, unlike most of the other instruments on the market. It is dedicated to elongation and load measurement. This is evident by its' state of the art, and extremely accurate, clock circuit (+/- 0,15 ns) which in itself is an achievement and important step to insure the best possible measurement - accuracy & integrity. The Instrument is simply the best innovation in the field of bolting since the introduction of the torque – wrench in the mid-1920s.

Graphical overview

	<ul style="list-style-type: none"> • Lightweight Handheld Instrument • 4,3" Medical grade back-lit touch screen recessed into casing for protection.
	<ul style="list-style-type: none"> • Strong, lightweight aluminum casing (177x140x38mm - 7x5,5x1.5") • IP44 Rated (Sealed) • Connector Ports protected by recess
<p style="text-align: center;">Topside View</p> 	<ol style="list-style-type: none"> 1. Connector Ports for Transducers, 2. Temperature Probe 3. ANC Port <p style="text-align: center;">(All Lemo type connectors)</p>
<p style="text-align: center;">Bottom View</p> 	<ol style="list-style-type: none"> 1. Mini USB-port 2. Charger port

Key Features and Specifications

- 480xRGBx272 - 4.3" Resistive Medical Grade touch screen LCD, LED backlit
- Will operate for 20 hours straight on LCD backlight running full with standard battery. Double battery pack is optional allowing 40 hours operation time.
- Connectors:
 - 2 X Ultrasonic: 2 – 00 Lemo
 - Temperature – 0B Lemo
 - I/O – 0B Lemo
 - USB – micro USB
- Light weight; only 800g with standard battery option.
- Ultrasonics:
 - Receiver: 90dB, full variable gain
 - Pulser: +- 80v, fully adjustable
 - A-D: 200MHz
 - Zero crossing precision: >0.15ns
- IP44 Rated
- Normal Operational conditions:
 - Indoor or protected use
 - Operating Temperature Range: -20 - +70 °C
 - Storage Temperature Range: -30 to +80 °C
 - Maximum relative humidity +60°C, 90% RH, 96hrs

Ultrasonics and bolts

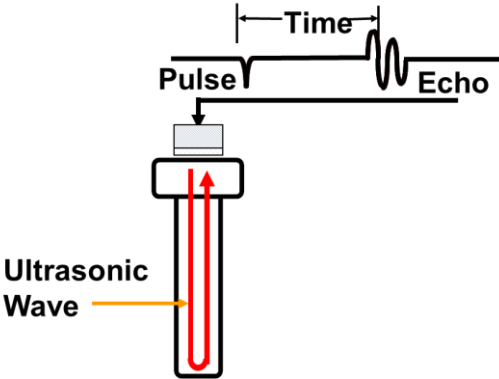
The technology of measuring bolt elongation and subsequent bolt load by using ultrasonics was pioneered by Douglas Aircrafts for the DC Air Shuttle programme and later by NASA for the assembly of the SSME (Space Shuttle Main Engines). The Technology has been used to measure bolt load in the field of Aerospace assembly, for safety and durability of assembly, for more than forty years. This method of measuring bolt assembly load has played an important part in enhancing airplane & flight safety, and has probably prevented more incidents and accidents than one can imagine.

A bolt or threaded fastener is essentially a stiff spring. And when it is loaded (via a torque tightening device - or tension tool) it should stretch. If the bolt does not elongate or stretch to a set target as a part of the bolted joint assembly process, it simply has no purpose. And the only way to accurately measure & ensure that a bolt is correctly installed, is to measure its' achieved elongation and henceforth its achieved preload condition.

The elongation that results from the bolt being loaded or tightened via a tension tool or torque wrench; or simply by a spanner or allen key, must be measured to ensure the integrity and accuracy.

Load (kN/Lbf) or achieved stretch/elongation (inch/mm) in a bolt is determined ultrasonically by measuring the change in the time-of-flight (TOF) of an ultrasonic wave pulse through a bolt comparing unloaded with loaded condition.

An ultrasonic signal is created by a surfaced handheld magnetic transducer or a chip (3x3mm) glued to the bolt surface. The transducer or chip creates an ultrasonic pulse based on a voltage spike from the instrument and 'listens' for the echo. The reading instrument then converts this echo into an extremely accurate time measurement (which for the DeltaSigma box is accurate to +/- 0,15 NanoSeconds) and converts it into a measure for elongation (inch/mm) and load (kN/Lbf)

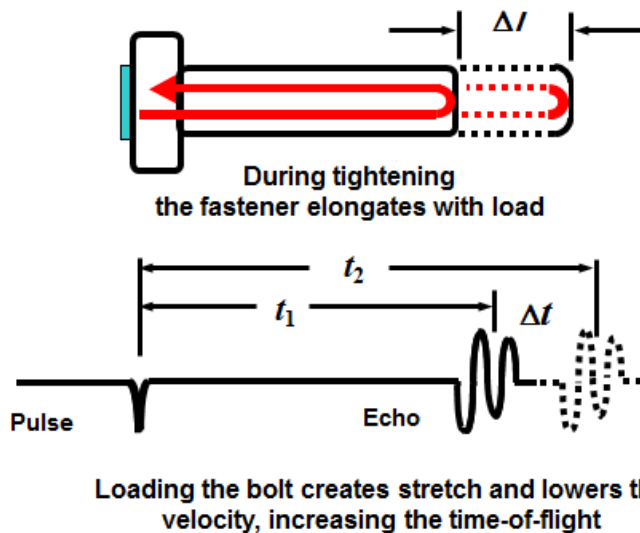


The ultrasonic pulse method is the only way to practically measure elongation and pre-load in fastener assemblies. It is the only method one can use universally to e.g. test a bolt assembly procedure in a lab, workshop or other manufacturing facility, and then continue to monitor the bolt condition through service life or at a service interval on site and in situ.

This method of measurement will disclose any anomalies such as in frictional, geometric, operational and other installation related issues that causes bolts to later fail in service. Monitoring fasteners over asset life time can also be extremely cost saving and prevent un-necessary maintenance and costly interventions.

An ultrasonic pulse/echo delta time measurement machine is essentially a range finder that measures the change in “distance” to the end or a chosen point towards the end of the fastener as it is loaded (stretches). The change in load (force achieved in the bolt) is proportional to the change in stretch (delta time). The delta load/delta stretch (stiffness in a spring) is constant for a fastener’s geometry: joint length and thread length diameters.

The figure below displays the reflection of the ultrasonic wave in the bolt:



When a fastener is loaded (tightened) or unloaded (operational loss or disassembly) the ultrasonic TOF will change due to the change of load (stress) in the fastener. It is this change in TOF that the instrument calculates, by storing a “Reference” length or time and calculates the difference between that “Reference” time and the “as found” time. This delta (change in) time is directly proportional to the load (Lbf/mm) or stretch (Inch/mm) in a fastener.

Kit content

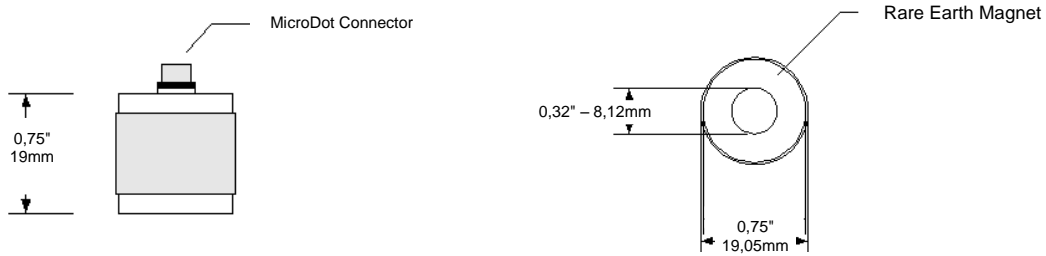
The standard kit is packed in a water-, dust- and shock proof Pelicase and consists of:

- The Delta Sigma instrument
- 1-2-3-4 Standard Transducer (Based on customer demand)
- Reading cable for glue-n transducers (Based on customer demand)
- 1 Temperature probe
- 1 Anc. Cable
- 1 bottle of ultrasonic Coolant fluid
- 1 Wall Charger
- 1 USB-cable

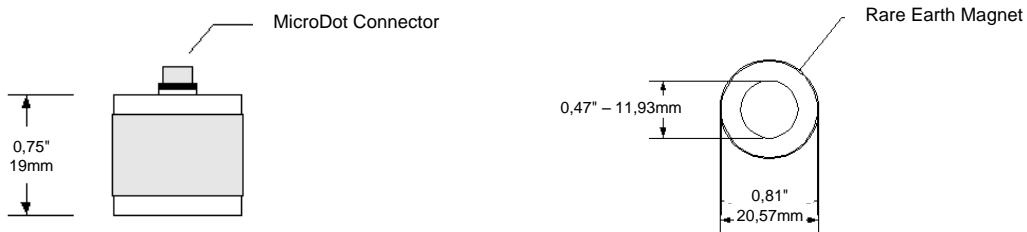
Accessories

Transducers

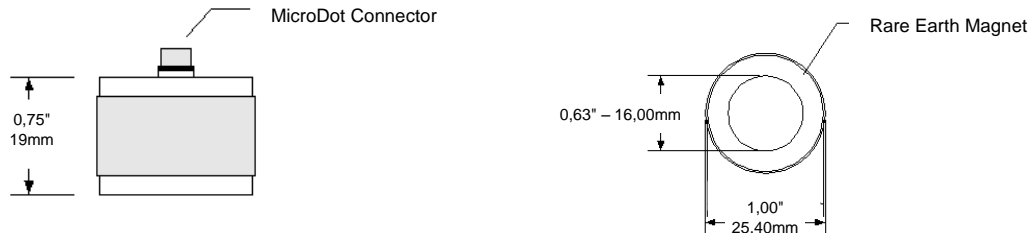
¼" Magnetic 5MHz – P/N 2050-02



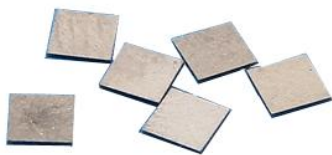
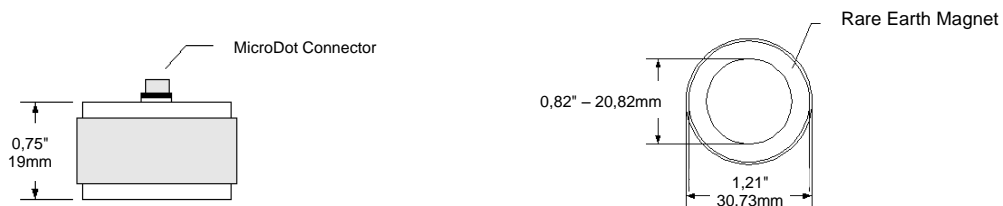
⅜" Magnetic 5MHz – P/N 2050-03



½" Magnetic 5MHz – P/N 2050-04











½" Magnetic 5MHz – P/N 2050-05



3x3mm Glue-on transducers – P/N 3000-01

The glue-on transducers comes in sheets of 100 transducers. They are simply glued-on the bolts and tested by using the 4000-TC or 4000-RH cable.

Accessories

Cables and heads	
	<p>L00M-174LN-10 – P/N: 4000-01 Standard 300cm shielded transducer cable with Microdot-to-Lemo 00 connector. This cable is also available with 90° Microdot connector.</p>
	<p>Test Cable 4000 – P/N 4000-TC 230cm test cable with Lemo 00 connector for Glue-on transducers. Used when the transducer is glued inside the female hex of a bolt where the Reading head cannot be used.</p>
	<p>Reading head – P/N 4000-RH Attached to the end of P/N 4000-01 instead of a transducer, this is used to read signals from the glue-on transducers.</p>
	<p>Ancillary Cable – P/N 4000-AC Lemo 00 to 5 separate leads for real time transfer of data to other applications or pump control.</p>
Other accessories	
	<p>Ultrasonic Couplant The Ultrasonic Couplant comes in a small 0,12l bottle. In order to have a firm connection between the bolt and the magnetic transducers, you need to apply a thin layer of Ultrasonic Couplant on the bolt head.</p>
	<p>Temperature Probe – P/N DS-TP The magnetic temperature probe is attached to a 3 meter cable. When attached to the bolt and connected to the instrument, instrument will adjust the length change due to temperature automatically.</p>
	<p>USB cable – P/N DS-USB A standard 2 meter USM Micro to USB-A. This is primarily used for data transfer between the instrument and a PC, but can also be used to charge the internal battery.</p>
	<p>Transport and storage Case P/N K1450 A water-, shock- and dust proof transport and storage case. The instrument, cables and transducers are all stored in designated compartments.</p>