

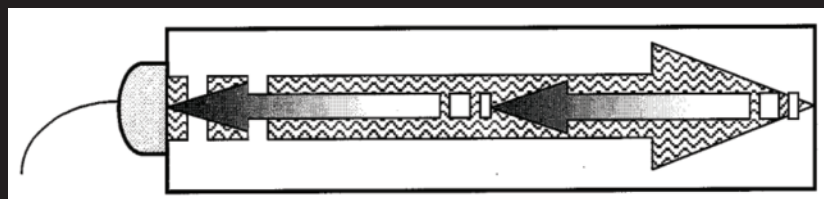
Ultrasonic Measuring



Integrated Solutions
to Piping Problems



The USM II Ultrasonic Bolt Meter is an electronic device which is used to measure extremely accurately, the extension of a bolt of virtually any material from 25mm to 15 meters in length. The physics governing the process are clearly understood and have been employed for many years in the fields of active sonar or radar. Send a pulse of energy toward an object (in this case the opposite end of the bolt) and measure the time between the initial pulse and the returning echo.

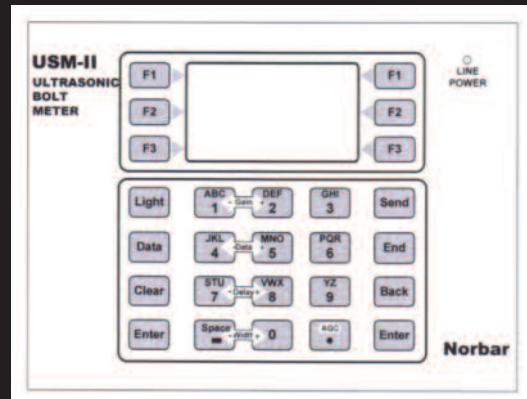
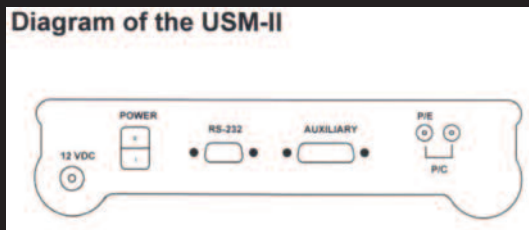


While the concept is comparatively simple and the ultrasonic measurement can produce extremely accurate results, the correct selection of the optimum bolt and transducer and their coupling can be difficult.

The objective when taking a measurement is to transmit as much sonic energy as possible from the transducer into the bolt and to send that energy to the greatest extent possible down and back the centre of the bolt as shown below.

Things which may cause interference with the reading can be the bolt ends not being square, dirt, corrosion or paint on the bolt ends. Also, if the bolt is not straight or has a defect in it such as a crack, it will cause a distortion in the reading.

Further information on this equipment can be provided on request along with references from users in other fields.



PHYSICAL DESCRIPTION

Size: 8.5" x 6.4" x 2"

Weight: 3.8 lbs

Keypad: Membrane switch with tactile keys

Display: 128 x 64 pixels with EL Backlight

Case: Sealed Aluminium

Power Optional
Battery: 4 x C Cells

Line Power: 90 – 250 VAC 47 – 63 Hz

Operating
Temperature 0 - 40°C/ 32°F - 104°F

Automatic Compensation for Temperature
Of Fastener

Calibration: Automatic verification of system
calibration. Field verification of bolt
material calibration constants

Data Output RS232 I/O

ULTRASONIC SPECIFICATIONS

Resolution: 0.0001 inch (0.002mm)

General: Pitch catch, pulse echo
measurement modes.
Automatic peak signal and phase
selection.

Pulser: 160 v olt push/pull tone burst
Selectable burst width

Receiver: Low noise preamplifier
Automatic gain control
Automatic waveform and signal
diagnostic display

Timing: 160 MHz 10 ppm TCXO controlled
digitizer -

Memory: 2 megabit non volatile. 1000 bolts,
5000 measurements

Ultrasonic Measurement of Threaded Fasteners

Torque is the most widely used method of measuring the integrity of bolted joints. However variations in friction and alignment mean that measuring the torque does not always give a precise measurement of the applied preload (or clamp load)

In addition some customers require that this preload be monitored over the service life of the fastener. While torque measurement methods such as "breakaway" or "backoff torque" exist, these require the fastener to be disturbed, and are time consuming.

In these situations, ultrasonic measurement of the preload has proven to be the most reliable and cost effective solution. Ultrasonic measurement of pre-load is made possible by using a predictable decrease in the velocity of sound within the body of the fastener as the stress is increased.

By introducing a sonic pulse at one end of the fastener, and accurately measuring the time required for the echo to return from the opposite end, the "ultrasonic length" of the unloaded fastener is determined. The "ultrasonic length" is very similar to the actual mechanical length although the figures are NOT interchangeable

As the fastener is tightened, the increase in stress in the material allows the USM to calculate the change in the "ultrasonic length". This elongation of "ultrasonic length" is the equivalent of the mechanical elongation of the fastener.

Details of the fastener specification can then be used to calculate and display the actual pre-load (clamping force) produced by the fastener.

Data is stored in groups of bolts with alphanumeric labels and comment fields (alphanumeric available on USM-II only) and can be downloaded to a PC and uploaded for future monitoring work. The optional utilities software makes interfacing easy even for new operators.

There is a 0-10V analogue output, useful for control of a tightening tool such as the range of torque multipliers. Control interfaces can be supplied on request.

The USM uses state-of-the-art hardware and software to achieve these measurements with maximum automation, and minimizes the need for operator interpretation. The previous generation of ultrasonic bolt length measurement devices required lengthy operator training, but the USM has built over 20 years of knowledge into a clear user interface, suitable for new and experienced users alike.

ULTRASONIC INSTRUMENTS

USM-I

Size:	197mm x 127mm x 279mm
Weight:	3.2kg
Keypad:	Sealed membrane with tactile keys
Display:	128 x 64 pixels with Backlight
Case:	Extruded and cast aluminium
Line Power:	90-250 VAC 47 to 63 Hz
Operating Temperature:	0° to 40°C (32° to 104°F)
Automatic Compensation:	for temperature of fastener
Calibration:	Automatic verification of bolt material calibration constants
Data Output:	RS232 I/O 0 to 10V Analogue Output
Resolution:	0.0001 inch (0.002mm)
General:	Pitch-catch, pulse-echo, and echo-echo measurement modes Automatic peaksignal and phase selection
Pulser:	360 volt push/pull tone burst. Selectable burst width. Selectable frequencies at 1.0, 2.25 and 5.0 MHz
Receiver:	Low noise preamplifier Automatic Gain Control Automatic waveform and signal diagnostic display
Timing:	160 MHz 10ppm TCXO controlled digitizer
Memory:	2 megabit non-volatile ram. 1000 bolts, 5000 measurements

USM-II

As USM-I except:-

Size:	216mm x 163mm x 51mm
Weight:	1.6kg
Case:	Extruded Aluminium with steel end plates
Battery Power:	4 'C' Cells
Pulser:	160 volt push/pull tone burst. Selectable burst width Selectable frequencies 1, 2.25, 5 and 10 MHz

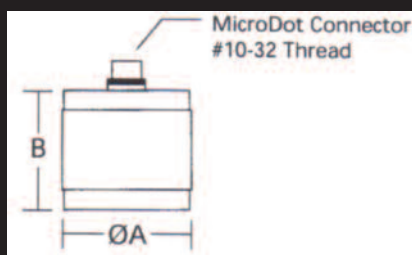
ULTRASONIC TRANSDUCERS

Magnetic Transducers

This standard style is used with ferrous materials, and consists of a rare earth magnet surrounding the piezo electric transducer. The diameter refers to the nominal diameter of the piezo electric crystal. The annular magnet increases the overall diameter to the value of 'A' shown. Temperature range: -20°C to +80°C (0°F to 180°F)

Diameter	Frequency	ØA (mm)	B (mm)
1/8"	5MHz	9.7	12.7
1/4"	5MHz	19.1	19.1
1/2"	5MHz	25.4	19.1
3/4"	2.25MHz	30.7	19.1

Other sizes and frequencies are available on request



Glue-on Transducers

Allows positive location on non-magnetic fasteners. Also ideal for temporary or permanent monitoring of all joints. Higher repeatability than magnetic transducers because of the position of the transducer on the fastener is constant. The cyanoacrylate adhesive acts as a couplant with good sound transmission properties. Operating temperature range is: -20°C to +80°C (0°F to 180°F). Transducers are built to order. Please contact Patriot International with your requirements.

SMART Glue-on Transducers

These glue-on units have in-built memory and allow both fast and simple monitoring of joints. Simply attach the transducer to a special version of the USM-II and the change in elongation or load since the last inspection can be displayed and recorded. Transducers are built to order. Please contact Patriot International.