Wykeham Farrance | CONTROLS GROUP

SOIL MECHANICS TESTING MADE EASY

P+S BENDER ELEMENTS

For measuring a soil sample's maximum shear modulus (G_{max})

Bender elements allow you to measure the maximum shear modulus (G_{max}) of a soil sample in order to evaluate its stiffness. G_{max} — typically with shear strain levels of about 0.001% — is a key parameter in low-strain dynamic analysis used to predict soil behaviour or soil structure interaction during earthquakes, explosion or machine and traffic vibrations.

Bender Elements connect directly to the compact and easy-to-install smart unit comprising a signal generator and oscilloscope which then links to a PC running Bender Element software.

High performance

Determining S & P wave velocities enables more specimen parameters to be determined. High speed data acquisition of up to 15 Mega samples/second sample interval provides the resolution necessary for determining wave speeds.

Compact and easy-to-install

This all-in-one turn-key system makes bender element testing reliable and easy to perform as it conveniently includes all the necessary tools such as wave generator, oscilloscope, PC software as well as bender element transmitter and receiver.

Robust design

The length of the bender element inserted into the soil sample is optimized to avoid compromising the power transmitted or received by the elements. This improves resistance to breakage, prolonging their life. Sample preparation is also easier, particularly on very stiff samples where only a small recess for the element is required.

User-friendly Graphic User Inferface (GUI)

The Bender Element software is intuitive allowing rapid and automated bender element tests to produce objective estimates of shear wave travel time using a range of algorithms (Time Difference, Cross Correlation and Phase Angle). This flexibility helps with the interpretation of shear wave travel as there are currently no official standards available.

Versatile

The system can be either added as an option to Banded Triaxial cells (upgraded with suitable kits including pedestal, top cap and porous stone); used stand-alone with optional accessories or; used to upgrade other manufacturers' systems.

Versatile P + S wave testing system

The complete STANDARD configuration suitable for Triaxial System includes:

Bender element with sintered bronze stone

Compact and convenient smart signal conditioning control unit comprising a signal generator and receiver to measure S & P wave velocities with LAN PC connection (note PC is not included).

Triaxial accessories kit for use with the Banded Triaxial Cell for compression or compression/tension test. The kit includes a base pedestal, top cap or vacuum top cap with integrated bender elements plus a pair of sintered bronze stones.

Additional optional bender elements configurations are available depending on users' requirements:

Detail of encapsulated bender elements

ENCAPSULATED BENDER ONLY mounted in the inserts. For use with an existing testing system.

STAND-ALONE CONFIGURATION with a suitable mounting system, for performing the test without confined pressure or vertical load.

Stand-alone configuration complete with master signal conditioning control unit

User-friendly software

According to the leading literature and research in this field, various algorithms are used to interpret wave signals:

Time Difference
The Time Difference algorithm computes the wave speed and Gmax with two different methods. The first measures the wave's flight time as a peak-to-peak difference between input and output signals. The second method measures instead the difference between the start of each signal.

Cross Correlation
The Cross Correlation measures the similarity between two signals, based on the displacement between each signal. Frequency domain analysis of cross correlation estimates the delay between input and output signals which can then be used to compute wave speed and Gmax.

Phase Angle
The Phase Angle method sees the specimen as a filter, analyzing the output signal as the filtered version of the input wave. The derivative with respect to pulsation of the phase is employed to estimate the grouped delay of the signals, allowing the computation of wave speed and Gmax.

Technical specifications

Max working pressure: 3500 kPa

Data acquisition speed: up to 15 Mega samples / second

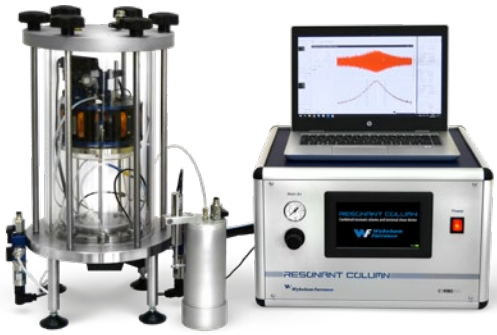
Gain range for data acquisition: x5 to x1000

Resolution of data acquisition (bits): 10

Multi-frequency test: up to 100 kHz

Multi wave generator: (sine, haversine, morlet)

Suitable for specimen with diameters ranging from 50 to 150mm (standard options only)



RESONANT COLUMN

Combined resonant column and torsional shear device

DYNATRIAX

Automatic dynamic triaxial testing machine

Wykeham Farrance Customer Care

At Wykeham Farrance, we are proud of our products.

As a valued customer of Wykeham Farrance, you will receive continuous, expert support and advice for your instrument. Furthermore, we offer full installation and training in the correct operation of your soil testing equipment.

For support from our expert Customer Care Team, contact your local Wykeham Farrance distributor or email **wfsupport@controls-group.com.**

Visit our website for more information **www.controls-group.com/wf.**

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