

SOIL MECHANICS TESTING MADE EASY

# RESONANT COLUMN

Combined resonant column and torsional shear device

**Standards** ASTM D4015

# RESONANT COLUMN

**Stainless steel cell** with acrylic transparent cylinder won't rust or corrode, increasing your equipment longevity.

**Internal floating frame** for assembling the electrical motor that applies torsional loads. **Suitable for 50 mm sample** as standard, as optional adapter for 38 mm diameter sample.

**Upper and bottom drainage** guarantees proper sample saturation.

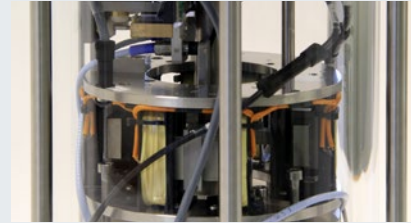
**Highly accurate LVDT** axial displacement transducer.

**Pressure transducers** for pore pressure measurement.

**High-sensitivity volume change device** with high-precision LVDT transducer.

## ELECTROMAGNETIC DRIVE SYSTEM

with eight coils for dynamic excitation from the top of the specimen. It includes two proximity transducers to monitor the rotation of the top cap assembly.

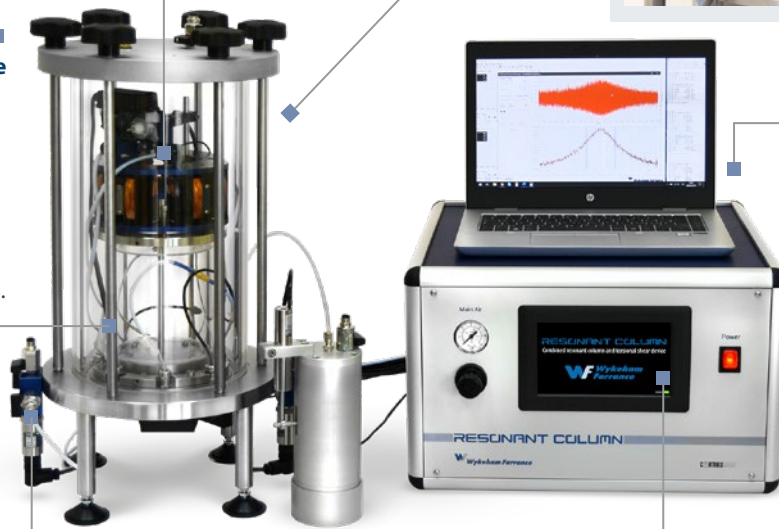


## Compact unit connected to laptop PC

contains all control, power supply and electrical and pneumatic devices. This system contains also the air actuators (I/P converters and the amplification equipment).

## Intuitive high resolution 7" color touchscreen display

makes cell, back and pore pressure easy to monitor.



## Technical specifications

**Maximum torque:** 1.5 Nm

**Maximum angular deformation:** 10°

**Maximum cell and back pressure:** 1 MPa.

**10 channels signal** conditioning unit

**USB data acquisition and signal generation board**

**Two electro-pneumatic converters** for cell and back pressure

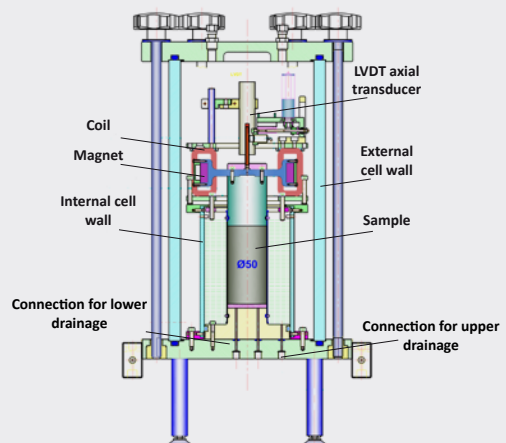
**Excitation frequency:** Dynamic (RC) 1-300 Hz;

Cyclic (TS) from 0 to 50 Hz

**Dimension:** Control Box 51 x 45 x 35 cm (H x W x D);

Cell 55 x 27 cm (H x diam.)

**Weight:** approx. 50 kg



# Software

The complete system includes a high quality PC supplied with pre-installed intuitive Windows-based software that allows you to perform both Resonant Column and Torsional Shear tests. The test stages are as follows:

## SATURATION

Ramp of cell pressure/back pressure is applied facilitating the air to dissolve for a complete saturation of the specimen. All the pressure readings are shown in real time using a intuitive high resolution colour display

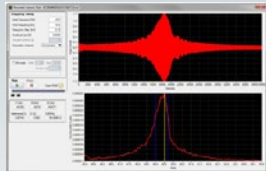
## ISOTROPIC CONSOLIDATION

The confining pressure is applied through the cell pressure until the soil is consolidated when pore pressure is dissipated and volume change is negligible.

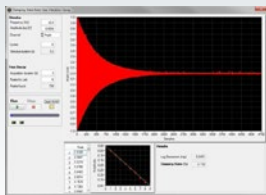
## RESONANT FREQUENCY

The soil specimen is restrained at the bottom and dynamically excited at the top. The generated frequency is up to 300 Hz and is increased automatically in "steady-state" mode by steps (RC discrete) or continuously (RC chirp), or in "free-decay" mode by only an initial frequency. Since the frequency of the input signal varies, the dynamic response of the specimen results in a varying motion amplitude. The secant shear modulus  $G$  is determined by the resonant frequency. The damping ratio  $D$  can be evaluated with two methods:

- In the frequency domain, from the complete frequency response of the soil specimen (half-power bandwidth)
- In the time domain, from free-vibration decay curve that is generated by shutting off the driving power (logarithmic decrement method).



Resonant frequency stage: "steady-state"



Resonant frequency stage: "free-decay"

### RC CONTINUOUS SWEEP — CHIRP

The technique used is the stimulation of the sample with a signal in which the frequency increase linearly with time.

### RANDOM VIBRATION EXCITATION

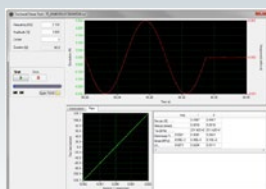
The transfer function of a system may be obtained using random noise as an excitation. A torque narrow band random signal, applied to the specimen, allows dynamic properties analysis at very small strain where standard tests are less accurate.

### FREE DECAY

The technique used is the stimulation of the sample with a signal of frequency equal to or near the resonant frequency. After a certain period of time the specimen is left free to oscillate and acquires the resulting transition.

## TORSIONAL SHEAR

The soil specimen is deformed cyclically at low frequency (maximum 10 Hz), whilst continuously monitoring torque and deformation. A sinusoidal current is applied while amplitude is increased. The system records the torsional stress and strain values displaying Hysteresis cycles from which secant shear modulus  $G$  and damping ratio  $D$  are determined.



Cyclic torque application in Torsional shear

### TORSIONAL SHEAR

The technique used is the input torsional rotation through a sinusoidal current applied to the coils.



**Cyclic Simple Shear**



**DYNATRIAX** EnS

Automatic dynamic triaxial testing machine

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