



- Clean
- High performance
- Easy

SOIL MECHANICS TESTING MADE EASY

**NEW**  **Electromechanical  
Servoactuation Product range**

EmS Technology for Soil mechanics testing made-easy



## Wide range of fully automatic tests

Wykeham Farrance's NEW Soil Mechanics range now benefits from the cutting-edge Electromechanical Servoactuation (EmS) technology allowing users to perform all advanced soil testing in full automatic mode, with ease.

Discover what makes our EmS soil testing equipment among the best on the market:



### Fully automatic

24/7 testing without interruption for maximizing your productivity and minimizing staff requirements.



### User friendly software

Perform routine Research Tests smoothly and obtain reliable and repeatable results according to the standards without any need for manual intervention thus reducing the risk of human error.



### Environmentally friendly and quiet

Systems equipped with the NEW Electro-mechanical Servoactuation (EmS) technology requiring no dead weights or large and noisy air compressors, drastically reducing noise levels.



### High performance

Our range of machines covers a wide range of stresses (loads/pressures) on soil thanks to our reliable and robust systems.



### Unique and exclusive modular system

allowing you to build your system gradually resulting in excellent Return-On-Investment ensuring that your laboratory machines never become obsolete.



### Ergonomic and compact

All machines are designed to have a small footprint for any type of laboratory, office or mobile facility.





**ACE** EMS TECH

**One-dimensional consolidation**

- Incremental loading (IL)
- Constant Rate of Strain (CRS) with measurement of pore pressure
- Swelling
- Controlled Hydraulic Gradient (CHG)

**Unconfined test**

**SHEARMATIC** EMS TECH



Direct/residual shear test

Incremental loading test

**TORSHEAR** EMS TECH



Ring shear test

**AUTOTRIAX2** EMS TECH



**Triaxial tests**

- Effective/Total stress (CD, CU, UU)
- Stress path
- $K_0$
- Permeability
- Unsaturated

**Other tests**

- Constant Rate of Strain (CRS)
- Unconfined compression (UC)
- California Bearing Ratio (CBR)

**DYNATRIAX** EMS TECH



**Static triaxial test**

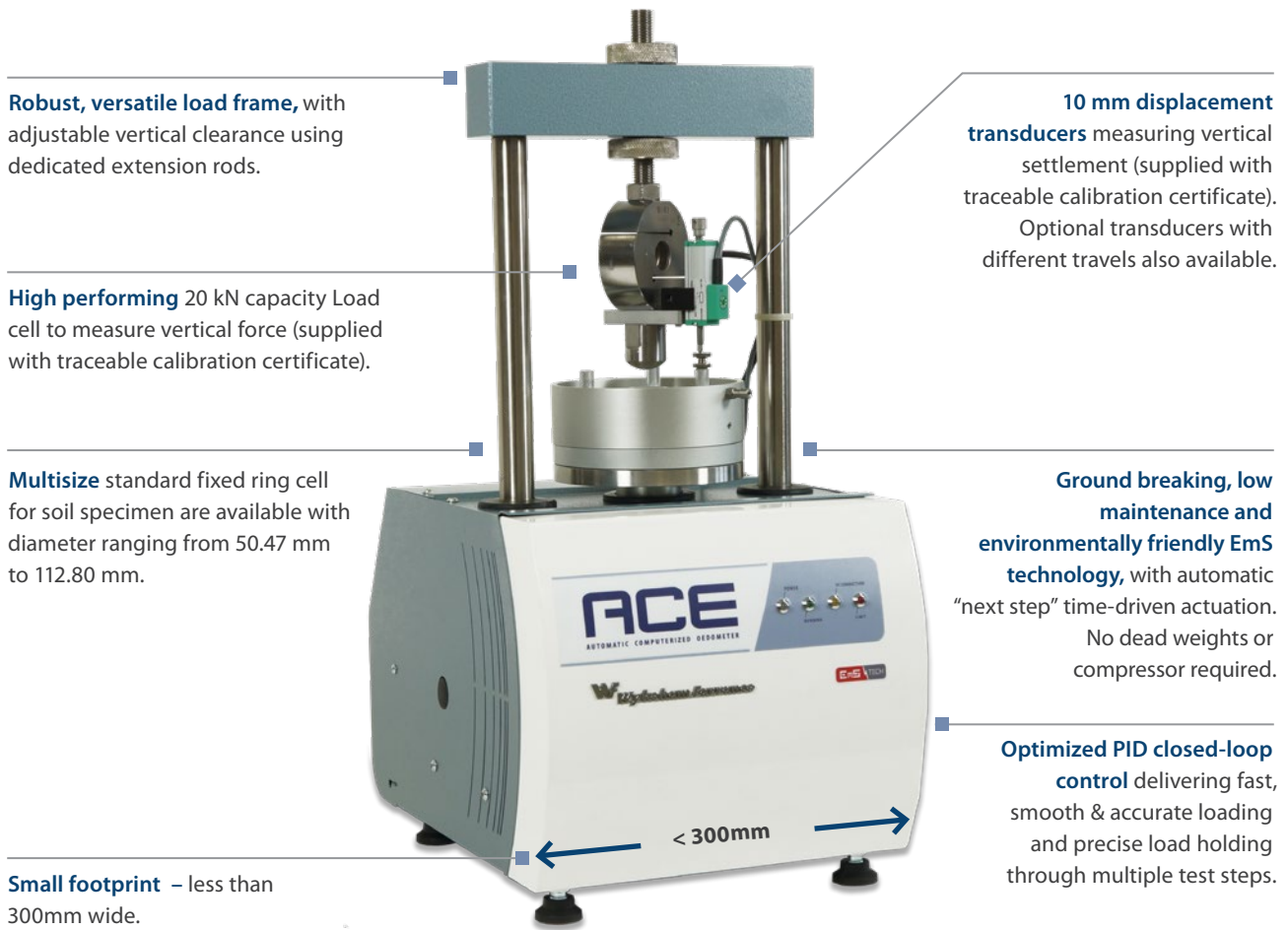
**Cyclic triaxial test**

**Unsaturated test**

**Resilient modulus test**

# Advanced Automatic Oedometer System for Soil Consolidation

BS 1377:5 | ASTM D2435 | ASTM D3877 | ASTM D4546 | NF P94-091 | EN 17892:5



**Robust, versatile load frame**, with adjustable vertical clearance using dedicated extension rods.

**High performing** 20 kN capacity Load cell to measure vertical force (supplied with traceable calibration certificate).

**Multisize** standard fixed ring cell for soil specimen are available with diameter ranging from 50.47 mm to 112.80 mm.

**Small footprint** – less than 300mm wide.

**10 mm displacement transducers** measuring vertical settlement (supplied with traceable calibration certificate). Optional transducers with different travels also available.

**Ground breaking, low maintenance and environmentally friendly EmS technology**, with automatic “next step” time-driven actuation. No dead weights or compressor required.

**Optimized PID closed-loop control** delivering fast, smooth & accurate loading and precise load holding through multiple test steps.

## Technical specifications

Maximum vertical force: 20 kN

Ram travel: 25 mm

Minimum testing speed: 0.00001 mm/min

Maximum testing speed: 50.00000 mm/min

Horizontal clearance: 175 mm

Vertical Clearance: 185 mm  
(265 mm with extension columns)

Dimension: 300 x 390 x 600 mm

Weights: 40 kg (approx.)

Power: 220-110 V, 50-60 Hz, 1ph

## Wide range of consolidation tests

- > **Incremental loading test** – BS 1377:5 | ASTM D2435 | EN 17892:5
- > **Swelling test** – ASTM D4546\*
- > **UC (Unconfined compression)** – ASTM: D2166/ BS 1377:7
- > **CRS (Constant Rate of Strain)** – ASTM D4186
- > **CHG (Controlled Hydraulic Gradient) test\***

\* Please contact our friendly pre-sale engineer specialists about components required to allow this test to be performed with standard software.

Access to various standard configurations



**PC Controlled configuration**

ACE EmS modular and expandable configuration connects up to 60 units via LAN port using the one PC software allowing you to build your laboratory without interruption — increasing productivity and profitability.



**CONNECT UP-TO 60 UNITS**

ACE EmS LAN – PC connection allows gradual modular expansion

**Local User Interface configuration**

**Our most compact configuration** — the combination of the ACE EmS with our high resolution 6" touch screen color display will give you full control of a single unit, without the need of a PC.

Numerical and graphical display of the readings are presented clearly and data is recorded on a sturdy, high-storage-capacity USB pen drive supplied with the system. All data is conveniently output in TXT format.



# CRS Test configuration

### Additional accessories required for this configuration:

- CRS cell
- Extension rods
- Pressure transducers
- One water pressure line

### CRS cell

- Continuous monitoring of test parameters (axial load, pore pressure, axial compression)
- Sample dimension 63.5 x 25.4mm
- Max. working pressure 3,500 kPa
- Relatively short time to perform consolidation test



Extension rods and centering pin for CRS (Constant rate of strain) and Unconfined (UC) test



Pressure transducer with de-airing block for pore pressure measurement



### Hydromatic Stand-alone

Hydromatic standalone is a compact and general-purpose water pressure source that also enables the ACE unit to measure volume change:

- Powers up to two hydraulic pressure lines and measures the associated volume changes
- Generates water pressure regulated under closed-loop control up to either 3,500 kPa or 1,700 kPa
- High resolution measurement of pressure (0.1 kPa)
- High volume capacity, 250 cc
- Lightweight with a small footprint
- No air compressor required

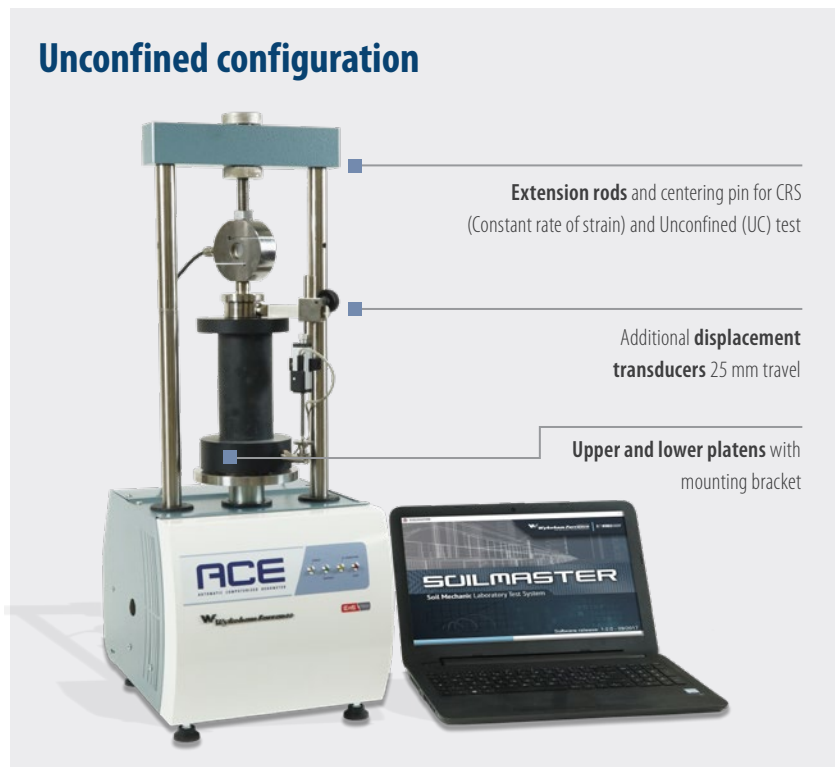


## Unconfined configuration

Extension rods and centering pin in CRS (Constant rate of strain) and Unconfined (UC) test

Additional displacement transducers 25 mm travel

Upper and lower platens with mounting bracket



For a complete test configuration, visit our web site or contact our dedicated team of experienced geotechnical engineers on [wfsupport@controls-group.com](mailto:wfsupport@controls-group.com).



# SHEARMATIC **EmS** TECH

## Advanced automatic direct/residual shear testing machine

ASTM D3080 | AASHTO T236 | BS 1377:7 | CEN-ISO/TS 17892-10 | NF P94-071

**Ground breaking, low maintenance and environmentally friendly EmS technology**, with automatic “next step” time-driven actuation.

No dead weights or compressor required.

**High performing** 10 kN capacity load cells to measure vertical and horizontal force (supplied with traceable calibration certificates).

**Save space** with its small footprint shorter than one meter.



**Fast, smooth and accurate** loading delivered by integrated optimized PID closed-loop control with precise load ensured by a load cell directly mounted on the loading tip.

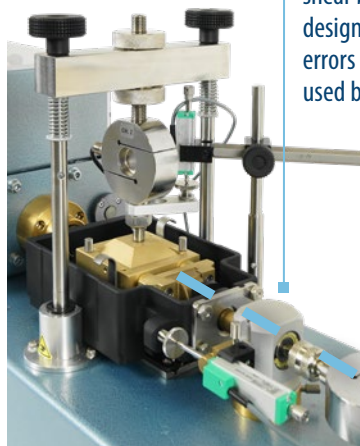
**10 mm and 25 mm displacement transducers** available for measuring vertical settlement and horizontal displacement (supplied with traceable calibration certificates).

### Technical Specifications

- Maximum vertical force:** 10 kN
- Maximum horizontal force:** 10 kN
- Max horizontal travel:** 23 mm
- Max vertical travel:** 12 mm
- Test speed:** from 0.00001 to 15.00000 mm/min.
- Maximum number of cycles:** 99
- Weight approx.:** 60 kg
- Sample type and size:** up to 100 mm square or round
- Dimensions approx. [l x h x d]:** 990 x 550 x 350 mm
- Multivoltage – Multifrequency power supply:** 230 V, 50 Hz or 110 V, 60 Hz

### High stiffness and sturdy design

The accurate axial transmission of the horizontal force is facilitated by a straight connection between shear box, shaft and load cell. This design avoids load measurement errors occurring with the commonly used basic “swan neck” design.



Light weight and easy to clean, the shear box carriage is made of high quality technopolymeric material, offering excellent resistance to corrosion and wear and tear caused by presence of chemicals often mixed with soil specimens.

## PC controlled – network option



### Totally new and ingenious software (optional)

- ✓ Allows the remote control, from a single PC, of multiple Shearmatic EmS machines. When using the Remote control mode, the PC software becomes the user interface and manages the main functions as well as the channels calibration by linear, polynomial and multi-coefficient curves.
- ✓ Can pilot up to **six** Shearmatic EmS units from **one single PC** with the user able to select single or multiple unit batches.
- ✓ Easily add more units by enabling the associated LAN communication (IP address) without complications or costs.
- ✓ Store calibrations of displacement transducers and load cells as txt file and easily recall up to 10 calibration points for each channel.



## Versatile machine with consolidation option

Shearmatic can be easily reconfigured to automatically perform oedometric consolidation tests by adding the following optional accessories:

- > Consolidation cell
- > Base adapter
- > Tip

---

Apply axial force steps instantaneously, using a pre-defined load sequence.

---

Ability to skip time, consolidation rate and swelling monitoring and move straight to the next step, even in automatic mode.

---

Vertical force load cell directly mounted on the loading tip delivers highly accurate readings and control signal.

---

Benefit from the use of standard consolidation cells.



# TORSHEAR



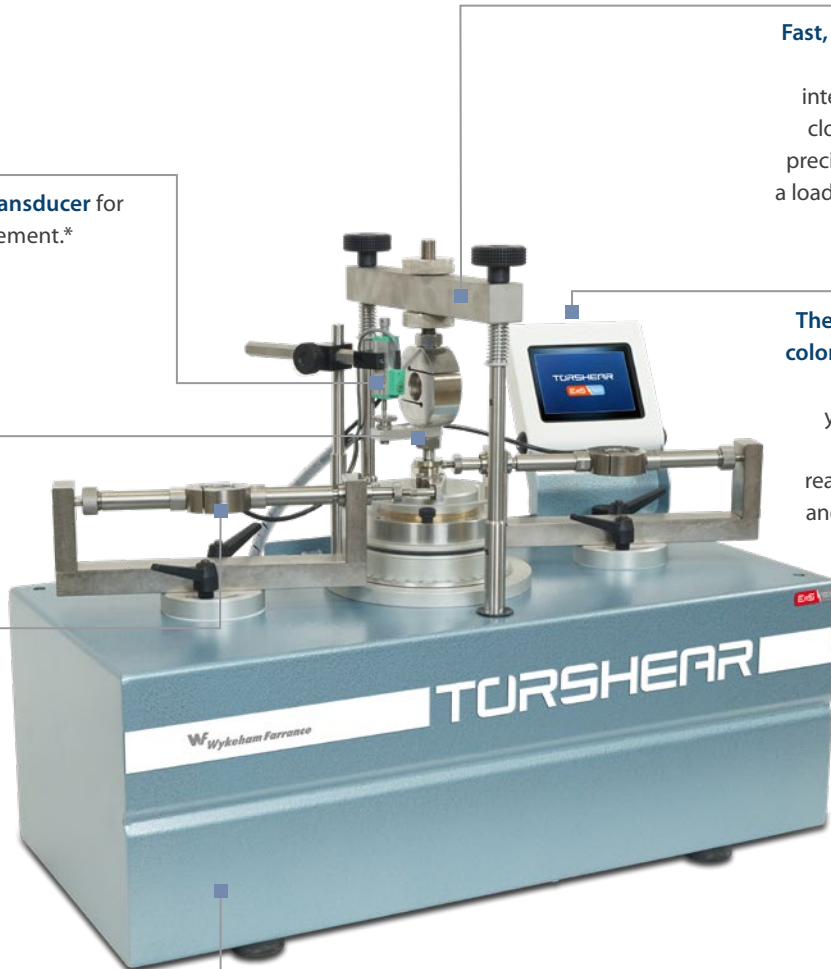
## Automatic ring Shear Testing Machine for Residual Strength of Soils

ASTM D6467 | ASTM D7608 | BS 1377:7

**10 mm displacement transducer** for measuring vertical settlement.\*

**High performing 5 kN capacity load cells** to measure vertical force.\*

**Easily removable 1 kN load cells** (for re-calibrating) deliver accurate measurement of torsional shear stress.\*



**Fast, smooth and accurate loading** delivered by integrated optimized PID closed-loop control with precise load ensured using a load cell directly mounted on the loading tip.

**The large 6" touchscreen color display and intuitive user interface** allows you to start, pause and stop the test, display readings during the tests and perform transducers calibrations with ease.

**Reliable, smooth and accurate torsional shear application** thanks to the rotational shearing action continuously applied by an electromechanical stepper motor.

\*Supplied with traceable calibration certificate.

### Technical Specifications

**Maximum Vertical stress:** 1,200 kPa

**Maximum Shear stress:** 1,000 kPa

**Test speed:** from 0.00001 – 1000%/min

**Weight approx.:** 60 kg

**Specimen dimensions:**

Internal dia. 70 mm; external dia. 100 mm

**Sample Area:** 40 cm<sup>2</sup>

**Weight approx.:** 60 kg

**Sample thickness:**

5 mm (various thicknesses available on request)

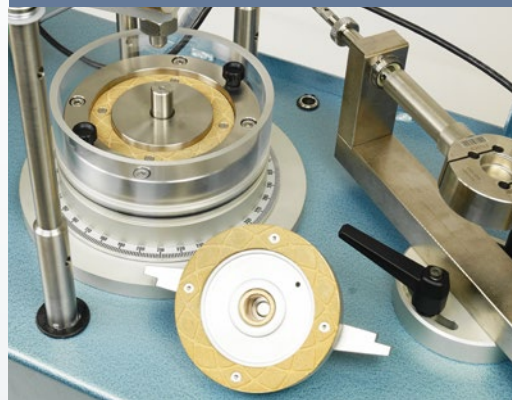
**Fully automatic standalone ring shear soil testing system** managed by local user interface with 6" touch screen high resolution color display for performing torsional ring shear tests in drained condition to determinate the residual shear strength of cohesive soil.

### HIGH PERFORMING

High-performing with maximum vertical stress 1,200 kPa and maximum shear stress 1,000 kPa, infinite variable speed from 0.00001 to 1000°/min, with pre-shearing stage selectable and adjustable number of cycles of shearing.

### High quality material

Stainless steel ring shear box (Area 40 cm<sup>2</sup>) with fitted easy removable sintered porous stones designed with special pattern.

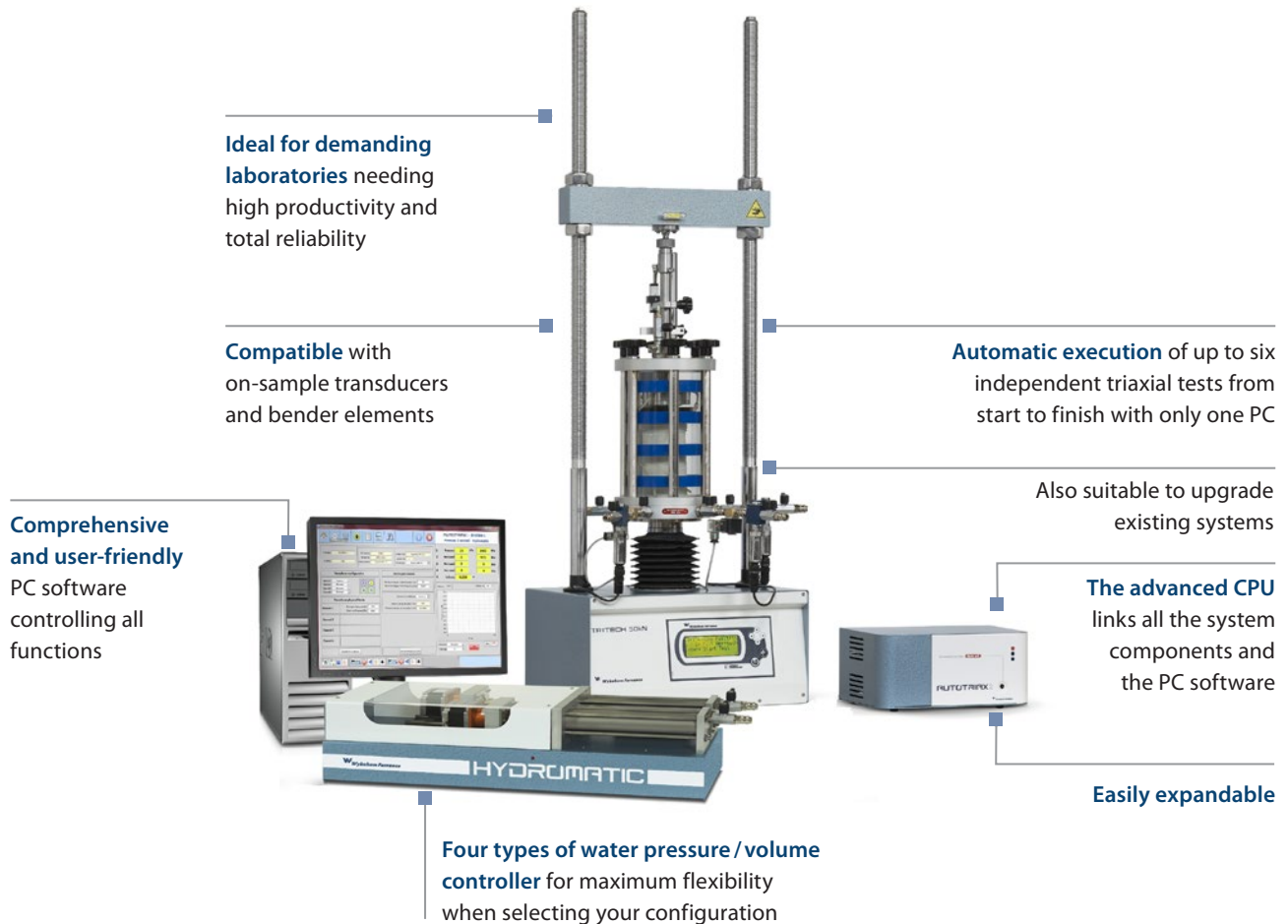




# AUTOTRIAX2 EmS TECH

## Fully automatic triaxial system

ASTM D2850 | ASTM D4767 | ASTM D7181 | BS 1377:6 | BS 1377:7 | BS 1377:8



### Technical specifications

Maximum no. of simultaneous tests: 6
Maximum no. of channels: 96 (in the most extended configuration)
Load capacity: 50 kN and 100 kN
Speed range: from 0.00001 mm/min to 99.99999 mm/min
Specimen range: 38, 50, 70, 100, 150 mm diameter
Water working pressure: 1,700 or 3,500 kPa
Pressure resolution: 0.1 kPa
Maximum capacity of pressure / volume controller: 250 cc
Volume resolution: 0.001 cc
Effective resolution: 131,000 points

### Benefits

- **Efficiency** — 24/7 testing without interruption, maximizing productivity and reducing demands on your staff.
- **Flexibility** — Ability to install software and fit additional accessories as required will enable the Autotriax2 to perform many types of tests.
- **Expandability** — The modular concept of the Autotriax2 allows for easy expansion and upgrade.
- **Reliability** — External factors and inconsistencies between different operators are eliminated; test procedures are always repeatable and compliant.

## Wide range of triaxial tests

ASTM D2850 | ASTM D4767 | ASTM D7181 | BS 1377:6 | BS 1377:7 | BS 1377: 8

### > EFFECTIVE STRESS TEST

The soil is first consolidated and is then taken to failure:

- CU (Consolidated Undrained)
- CD (Consolidated Drained)

### > TOTAL STRESS TEST

The consolidation is not performed until to failure is reached:

- UU (Unconsolidated Undrained)

### > STRESS PATH TEST

To replicate the changes in stress experienced in-situ during natural events, excavations and constructions.

### > K<sub>0</sub> TEST

To perform stress paths along the  $k_0$  loading line.

### > PERMEABILITY TEST

To measure, during a triaxial test, the hydraulic conductivity (coefficient of permeability) of water saturated porous materials.

### > UNSATURATED TEST

To simulate the behavior of soil in unsaturated conditions by adopting the axis translation method with High Air Entry Stone (HAES).

## Additional tests

### > CRS – CONSTANT RATE OF STRAIN TEST     ASTM D4186

Constant Rate of Strain test (CRS) is performed to determine the one-dimensional consolidation properties of saturated cohesive soils using axial strain-controlled conditions, when the soil specimen is restrained laterally and drained axially to one surface. It quickly allows you to determine the consolidation properties of soils with continuous monitoring of base pore pressures, vertical stress and vertical displacement.

### > UC – UNCONFINED COMPRESSION TEST     ASTM D2166 | EN 17892:7

The Unconfined Compression (UC) test measures the unconfined compressive strength of cohesive soils using axial strain-controlled conditions. This test will allow you to subject the soil to a constant rate of strain during which, axial force and axial deformation are measured.

### > CBR – CALIFORNIA BEARING RATIO TEST     ASTM D2166 | EN 17892:7

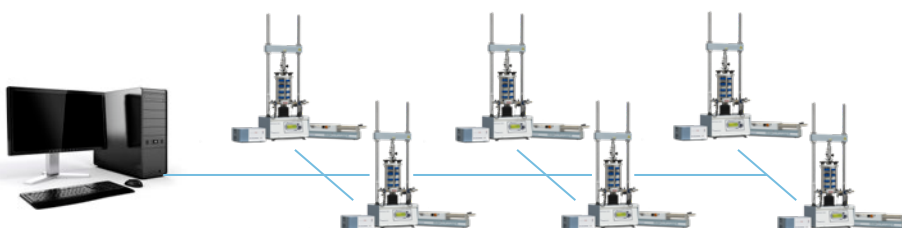
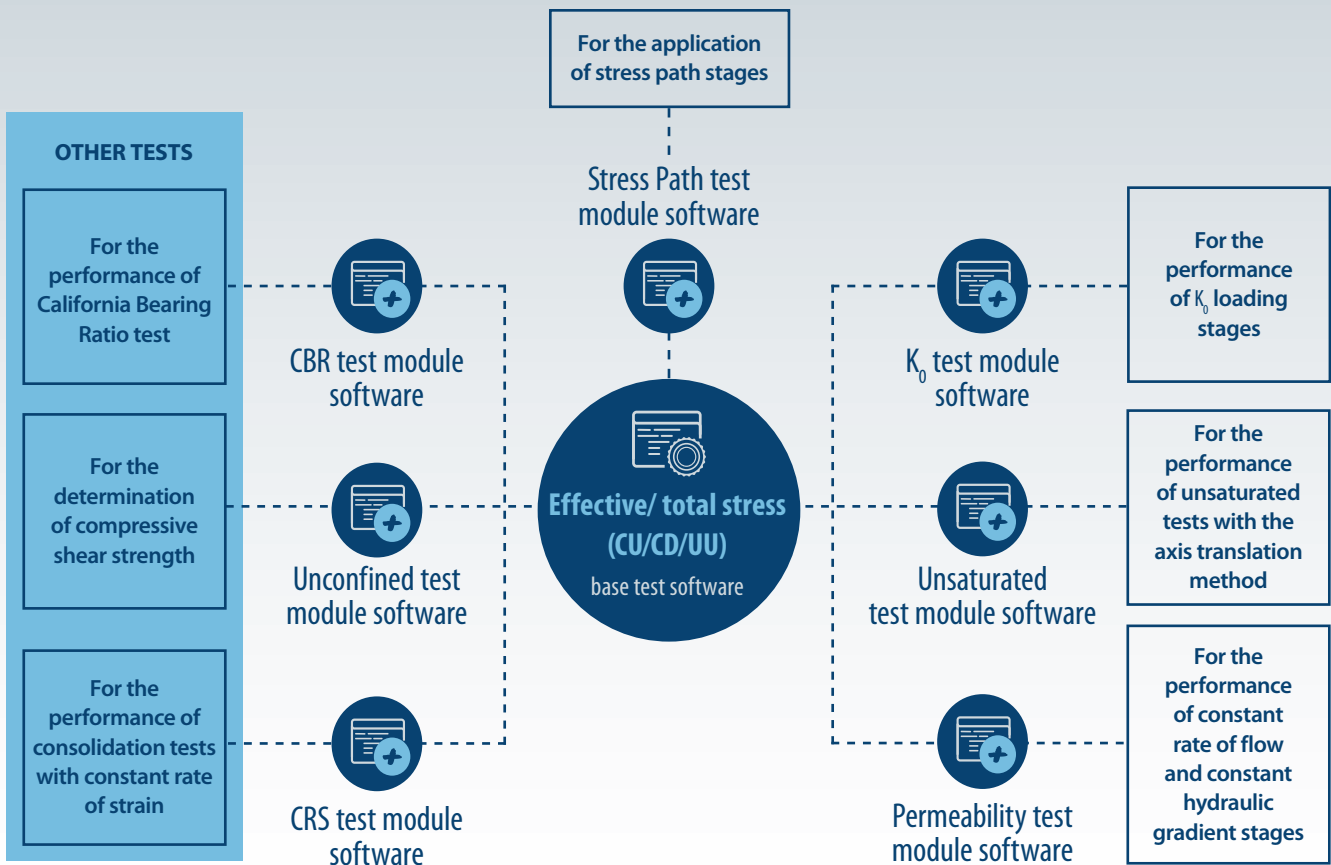
The California Bearing Ratio test (CBR) is a penetration test for evaluating the bearing capacity of subgrade natural or compacted soil for design of flexible pavement.

# Triaxial tests and many others

You can gradually expand the Autotriax 2 configurations to control further tests by adding the necessary components. This can easily be done on-site by configuring our user-friendly and Plug-and-Play software. The closed-loop feedback control system continuously monitors the components status so that, at each stage of the test, it can adapt to any change in the pre-set parameters.

Over 100 configurations are available enabling your system to perform many triaxial and geotechnical tests, each using its dedicated software package and corresponding accessories.

## DEDICATED SOFTWARE PACKAGES

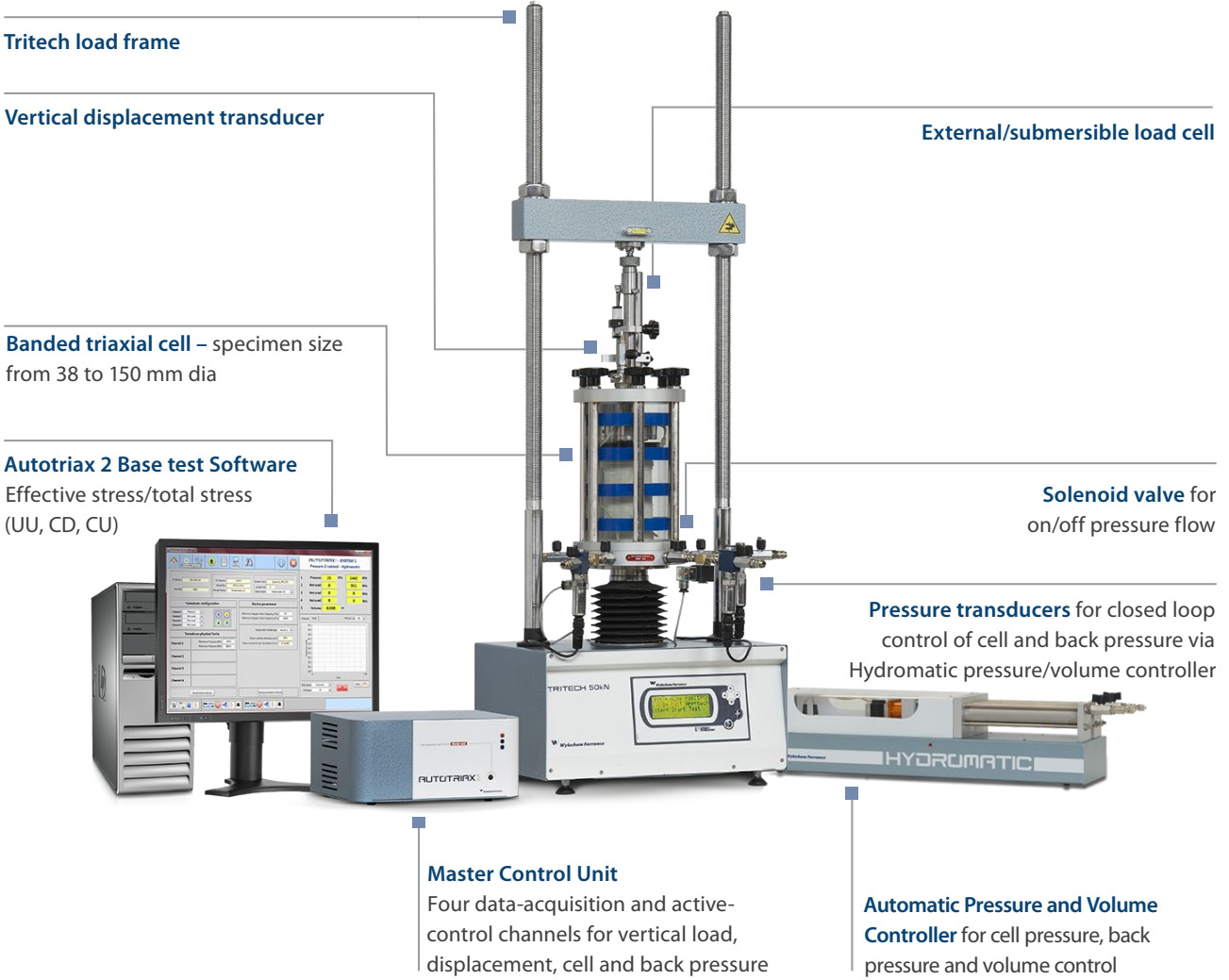


Up to six independent systems with different configurations can be controlled by the same PC.



**Triaxial test configuration**

# Effective/total stress tests



## $K_0$ , Stress Path tests

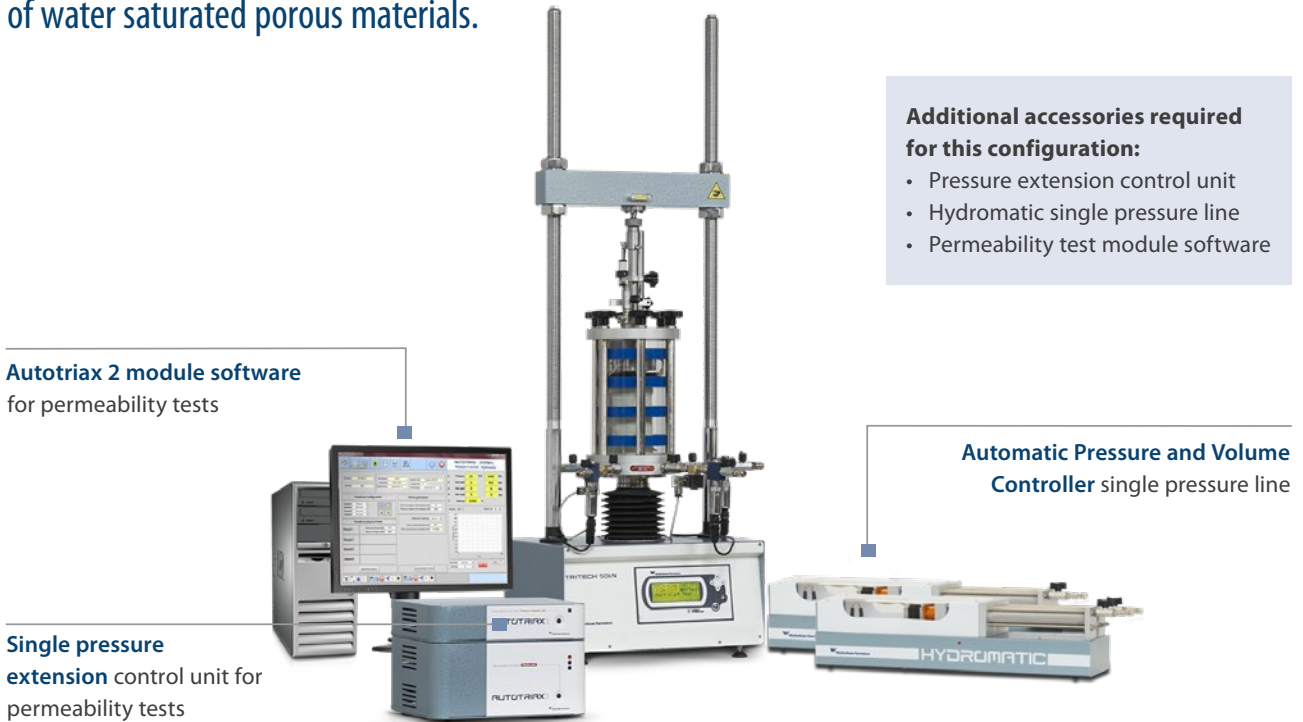
$K_0$  and Stress Path triaxial tests allow you to replicate the changes in stresses experienced in-situ during natural events, excavations and constructions.

- Additional accessories required for this configuration:**
- Submersible load cell
  - Vacuum top cap for triaxial tension
  - $K_0$  test module software
  - Stress Path test module software

## Triaxial test configuration

# Permeability tests

This test allows laboratory measurement of the hydraulic conductivity (coefficient of permeability) of water saturated porous materials.



**Additional accessories required for this configuration:**

- Pressure extension control unit
- Hydromatic single pressure line
- Permeability test module software

**Autotriax 2 module software** for permeability tests

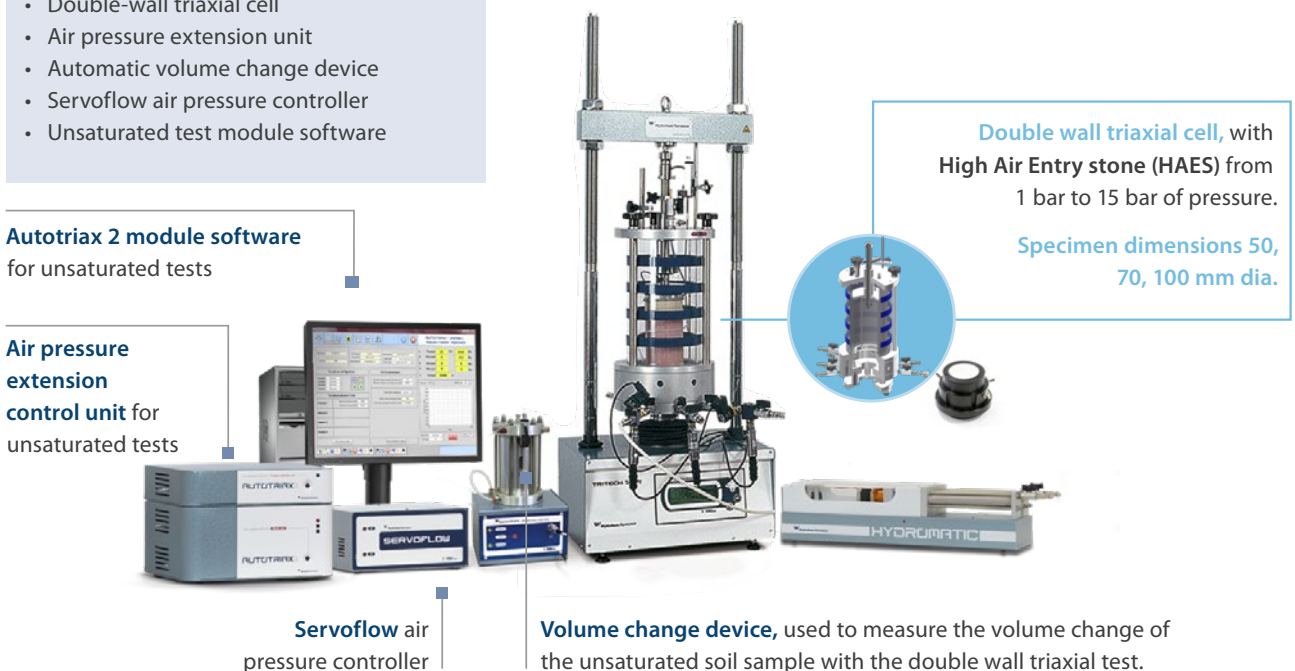
**Automatic Pressure and Volume Controller** single pressure line

**Single pressure extension control unit** for permeability tests

# Unsaturated triaxial tests

**Additional accessories required for this configuration:**

- Double-wall triaxial cell
- Air pressure extension unit
- Automatic volume change device
- Servoflow air pressure controller
- Unsaturated test module software



**Autotriax 2 module software** for unsaturated tests

**Double wall triaxial cell**, with High Air Entry stone (HAES) from 1 bar to 15 bar of pressure.

**Specimen dimensions** 50, 70, 100 mm dia.

**Air pressure extension control unit** for unsaturated tests

**Servoflow** air pressure controller

**Volume change device**, used to measure the volume change of the unsaturated soil sample with the double wall triaxial test.

## Other test configurations

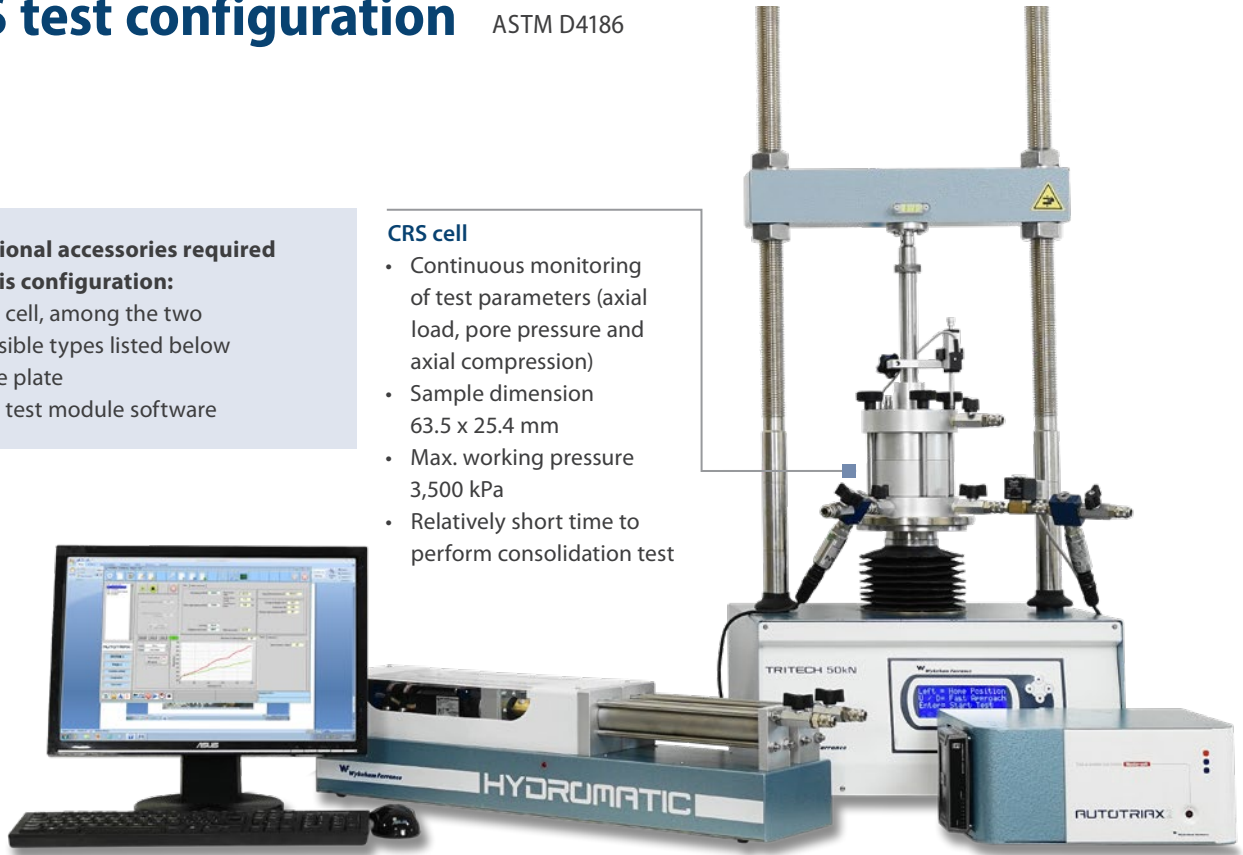
### CRS test configuration ASTM D4186

**Additional accessories required for this configuration:**

- CRS cell, among the two possible types listed below
- Base plate
- CRS test module software

**CRS cell**

- Continuous monitoring of test parameters (axial load, pore pressure and axial compression)
- Sample dimension 63.5 x 25.4 mm
- Max. working pressure 3,500 kPa
- Relatively short time to perform consolidation test



### Unconfined test configuration ASTM D2166 | EN 17892:7

The Unconfined test measures the unconfined compressive strength of cohesive soils using axial strain-controlled conditions. The soil is subjected to a constant rate of compressive strain during which, axial force and axial deformation are measured.

**Additional accessories required for this configuration:**

- Upper and lower platens
- Transducer bracket
- External load cell
- Unconfined test module software

### CBR test configuration EN 13286-47 | ASTM D1883 | AASHTO T193

The California Bearing Ratio test (CBR) is a penetration test for evaluating the bearing capacity of subgrade natural or compacted soil for design of flexible pavement.

**Additional accessories required for this configuration:**

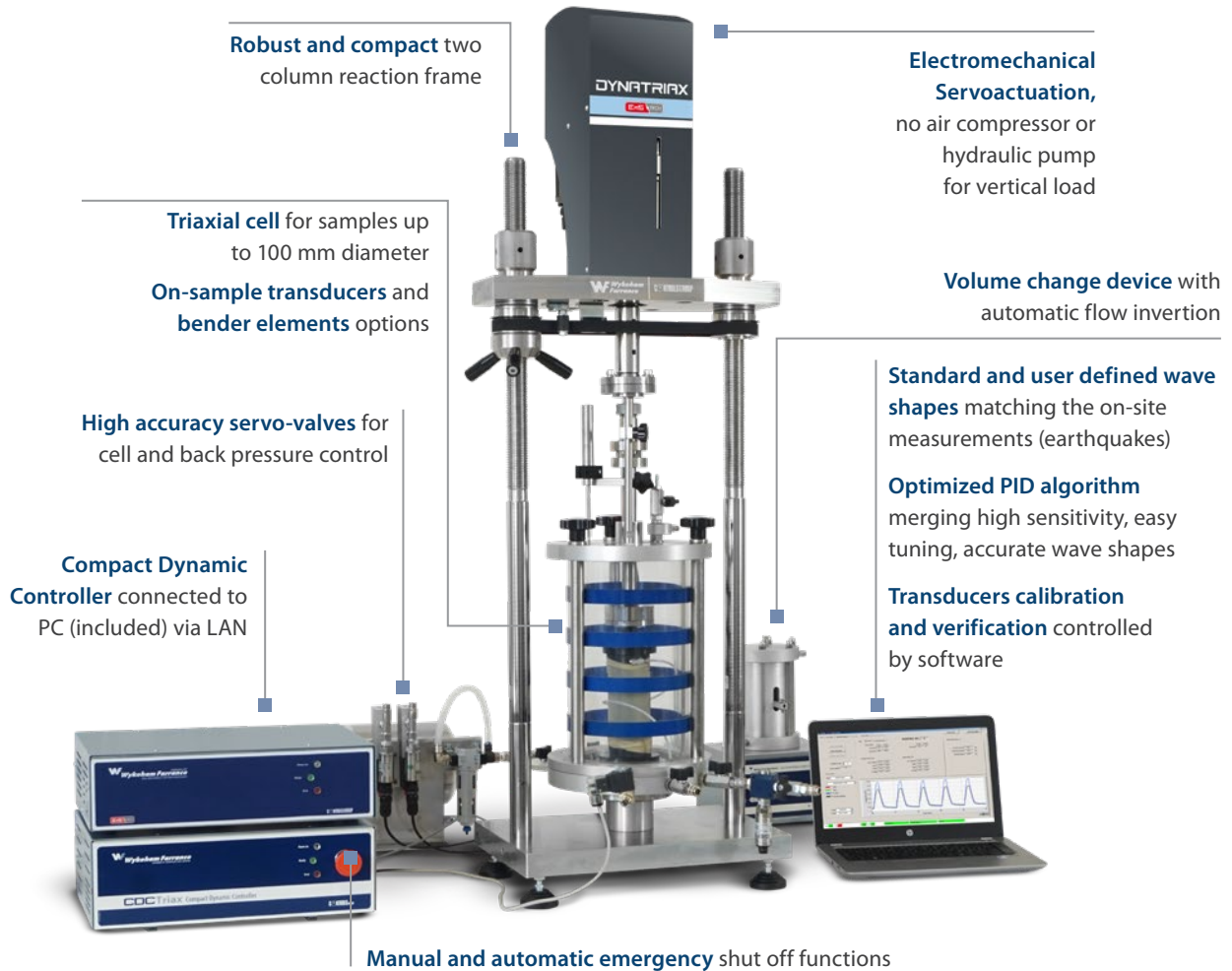
- CBR Penetration piston
- CBR mold
- External load cell 50kN
- CBR test module software



# DYNATRIAX EMS TECH

## Dynamic Triaxial System

ASTM D2850 | ASTM D4767 | ASTM D7181 | ASTM D3999 | ASTM D5311 | BS 1377:7 | BS 1377:8 | AASHTO T307



**Robust and compact** two column reaction frame

**Triaxial cell** for samples up to 100 mm diameter  
**On-sample transducers and bender elements** options

**High accuracy servo-valves** for cell and back pressure control

**Compact Dynamic Controller** connected to PC (included) via LAN

**Electromechanical Servoactuation**, no air compressor or hydraulic pump for vertical load

**Volume change device** with automatic flow inversion

**Standard and user defined wave shapes** matching the on-site measurements (earthquakes)

**Optimized PID algorithm** merging high sensitivity, easy tuning, accurate wave shapes

**Transducers calibration and verification** controlled by software

**Manual and automatic emergency** shut off functions

### Technical specifications

**Maximum Dynamic force:** ±15 kN

**Maximum Static force:** ±10 kN

**Maximum vertical travel:** 50 mm (longer travels available)

**Maximum testing frequency:** more than 10 Hz (depending on testing conditions)

**Volume change measure:** 100 cc volume change device with automatic flow inversion

**Maximum confining pressure:** 1,000 kPa

**Maximum back pressure:** 1,000 kPa

**Close loop control frequency:** 10 kHz

16-bit ADC input channels for transducers (16 channels)

110-220 V, 50-60 Hz, 1 ph

### Benefits

- **Electromechanical Servoactuation technology** offers excellent reliability, is more accurate and requires less maintenance.
- **Three axis closed loop control** for axial load or displacement, cell and back pressure.
- **Multitasking, user-friendly Windows-based**, PC software supplied pre-installed and ready to use to control the entire triaxial test and associated parameters.
- **Complete automation of all test stages** using high sensitivity closed-loop P.I.D. feedback control
- **Versatile** with ability to perform Static, Dynamic and Unsaturated soils triaxial tests.
- **Standard and user defined wave shapes** also derived from on-site measurements (from violent earthquakes to sedate ocean waves).

## Static and Cyclic triaxial tests

ASTM D2850 | ASTM D4767 | ASTM D7181 | BS 1377:6 | BS 1377:7 | BS 1377: 8

The Dynatriax EmS allows to perform a complete range of triaxial tests:

> EFFECTIVE STRESS

> STRESS PATH

>  $K_0$

> CYCLIC

## Additional tests

### > UNSATURATED SOIL TESTING PACKAGE

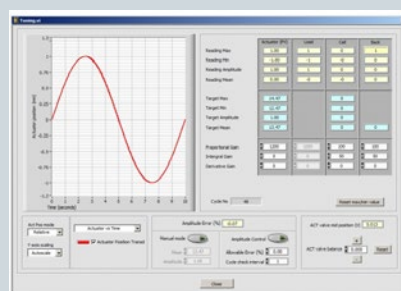
For the determination of mechanical parameters and soil water retention properties of soils in unsaturated condition.

### > RESILIENT MODULUS

For the determination of Resilient modulus on compacted samples under conditions representing a simulation of the physical conditions and stress states of materials beneath flexible pavements subjected to moving wheel loads.

## High performance actuator with highly sophisticated P.I.D control

The high performance actuator provides the electromechanical application of vertical loads in dynamic conditions up to 15 kN with a sophisticated PID closed-loop control, ensuring load is reached fast, smoothly and accurately and then maintained with a high level of accuracy. The submersible load cell delivers high accuracy from the lowest values.



# Dynatriax Software stages

The multi-tasking, user-friendly, windows-based software is pre-installed on the computer supplied with the system. The software provides control of the following test stages and utilities of a cyclic triaxial test:

## Saturation stage

- Cell pressure increments with B value check
- Back pressure increments with volume change measurement
- Cell and back pressure ramp

## Consolidation stage

- Isotropic consolidation with continuous volume change measurement

## K<sub>0</sub> consolidation stage

Vertical loading with sample diameter control using either:

- Direct measurement by radial belt with on-sample transducers
- Measurement of sample volume change and height

## Stress path stage

- Horizontal and Vertical Stress
- s, t (average stress and shear stress)
- p, q (mean normal stress and deviator stress)
- Vertical stress using strain control

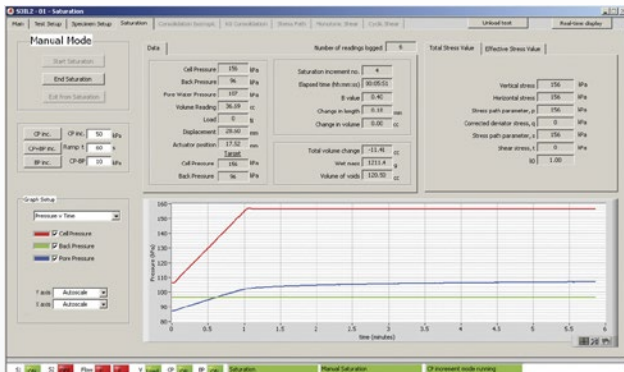
## Monotonic shear stage

- Strain controlled static shear stage, drained or undrained
- Loading in compression or extension, using the vertical mechanical actuator

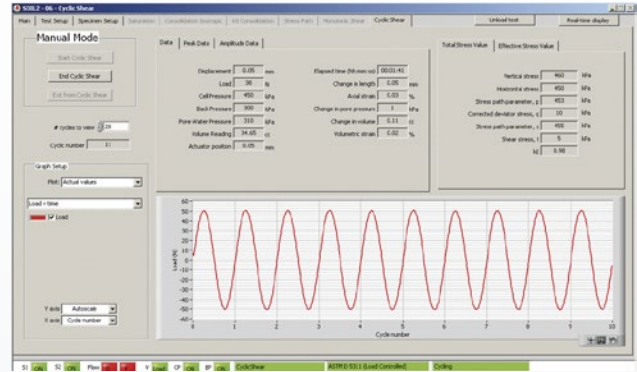
## Cyclic shear stage

A cyclic shear method can be selected from the following options:

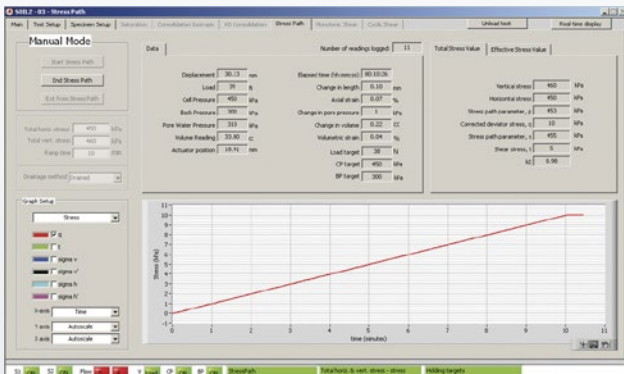
- ASTM D5311 Load Controlled Cyclic Strength
- ASTM D3999 Load Controlled Modulus & Damping
- ASTM D3999 Displacement Controlled Modulus & Damping
- Non Standard Single or multi Cycle test
- User defined or imported wave shapes



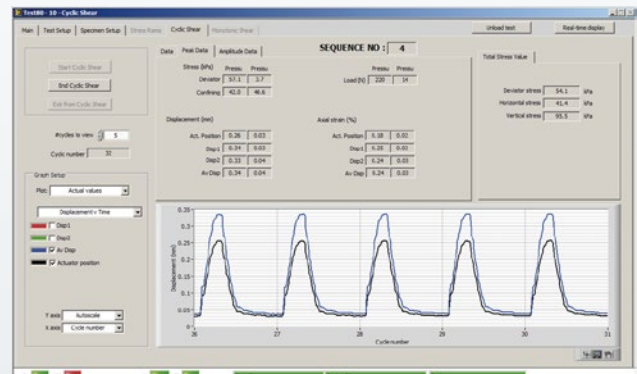
The graph on the saturation panel can display cell, back, pore pressure and volume change vs. time.



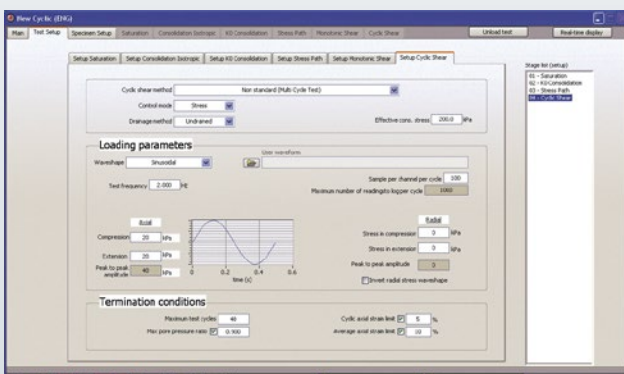
Stress-controlled cyclic shear stage. Real time measurements, compression/extension and amplitude values are displayed.



The graph on the stress path panel displays calculated stresses and strain vs. time.



Resilient modulus software package provides live monitoring of the sample's compression during the application of the pulse sequence.



Cyclic stage set-up panel showing parameters for a non-standard test method.



Young's and shear modulus are monitored during the cyclic stage.



# Complete market-leading range

From entry-level soil testing equipment to fully automatic PC-controlled machines for consolidation, shear, triaxial, static and dynamic testing, **our equipment range suits all needs and budgets.** Advanced systems are also available for research applications requiring an even higher degree of complexity.

## OEDOMETRIC CONSOLIDATION

### STANDARD FRONT-LOADING OEDOMETER



**Analogue configuration**  
Dial Gauge



**Electronic Configuration**  
Displacement transducer and GEODATALOG8

## DIRECT/RESIDUAL SHEAR TESTING MACHINE



**DIGISHEAR**

- Analogue configuration
- Electronic configuration, GEODATALOG8



**AUTOSHEAR**

**Electronic configuration**  
with built-in data acquisition

**STANDARD STATIC TRIAXIAL SYSTEMS**
**BUILT IN DATA ACQUISITION**


Configuration with automatic pressure/volume controller, HYDROMATIC STANDALONE



Configuration with Air/ water bladders and volume change device

**EXTERNAL DATA ACQUISITION**


Configuration with automatic pressure/volume controller, HYDROMATIC STANDALONE



Configuration with Air/ water bladders and volume change device

**DYNAMIC TESTS**

**RESONANT COLUMN**

Combined resonant column/torsional shear device for the automatic determination of damping ratio from half power band with and free vibration decay method.


**CYCLIC SIMPLE SHEAR**

Dynamic shear test apparatus for soil behavior prediction under dynamic conditions.