



Wykeham Farrance

Since 1941

DYNATRIAX

DYNAMIC TRIAXIAL SYSTEM

IS FLEXIBLE

in programming
dynamic triaxial, stress path
and unsaturated soil tests

IS RELIABLE

in complete test automation

IS MODULAR

in multi-stage testing program



NOW you decide how to run dynamic triaxial test

DYNATRIAX

The dynamic triaxial system developed using the latest technologies and decades of WF experience in the dynamic soil testing field, ideal for commercial and research laboratories.

FLEXIBILITY

- **Three axis closed loop control** for axial load or displacement, cell and back pressure
- Operating **frequency up to 10 Hz**
- **Two dynamic load/displacement options:**
 - Up to ± 15 mm (± 5 kN actuator)
 - Up to ± 25 mm (± 14 kN actuator)
- **Two load frame** options: 50 and 100 kN
- Capability to perform **static** (effective stress and stress path), **dynamic** and **unsaturated soil** triaxial tests
- Available upgrade for **bender element** testing, **local strain** and **mid height pore pressure** measurement

MODULARITY

- Test setup by unique programmable **multi-stage test procedure:** during the test run, access to all controls to expand and modify the stages according to the response of the soil specimen
- Designed to easily **integrate existing static systems**

RELIABILITY

- **Standard and user defined wave shapes** also derived from in situ measurements (from violent earthquake to sedate ocean waves)
- **Complete test automation** of all test stages using an high sensitivity closed loop P.I.D. feedback (up to 10 kHz)
- **Automatic compensation** of cell/back pressure during dynamic stage
- **Transducers calibration and verification** management by the software
- Manual and automatic **emergency air shut off function**

DYNATRIAX

COMPONENTS AND SPECIFICATIONS

The **DYNATRIAX** is a computer controlled servo-pneumatic system designed to perform the static and dynamic stages of a triaxial test.

The system manages three closed loop axis:

1. Vertical load/displacement
 - up to ± 15 mm (± 5 kN actuator)
 - up to ± 25 mm (± 14 kN actuator)
2. Cell pressure up to 1000 kPa
3. Back pressure up to 1000 kPa

The base system includes:

Tritech 50 or Tritech 100 load machines

The TRITECH digital loading machine is a microprocessor controlled drive system, specifically designed to perform both static or dynamic tests.

- Static load capacity: 50 kN or 100 kN
- Static vertical displacement up to 100 mm (machine travel)

Actuator

The double acting pneumatic actuator is digitally controlled and includes an integrated LVDT displacement transducer to control the position and the movement of the piston during the test.

- Dynamic load capacity: ± 5 kN or ± 14 kN
- Dynamic vertical displacement with travel up to ± 15 mm or ± 25 mm
- Operating frequency up to 10 Hz (depending on test conditions)

Min. air supply: 800 kPa - Max. servovalve frequency: 70 Hz.

Data Acquisition, process & control system

The **CDC – Compact Dynamic Controller** is a compact self contained unit that manages the three closed loop axis (vertical load/displacement, cell and back pressure) with a control loop rate of 10 kHz. It provides the automatic control of the system and drives the servovalve units of the three axis and two on/off valves, one connected to the drainage line and one connected to the air main supply of the triaxial cell. The CDC communicates with the PC through an Ethernet communication link (1 Gbit/s). The controller has sixteen transducer input channels using 16 bit ADC. Max. servovalves frequency: 70 Hz.

Dynatriax includes PC and software that provides the control of all test stages in automatic mode.

The air reservoir is provided with two servo valves for cell and back pressure control.

On/off valve.

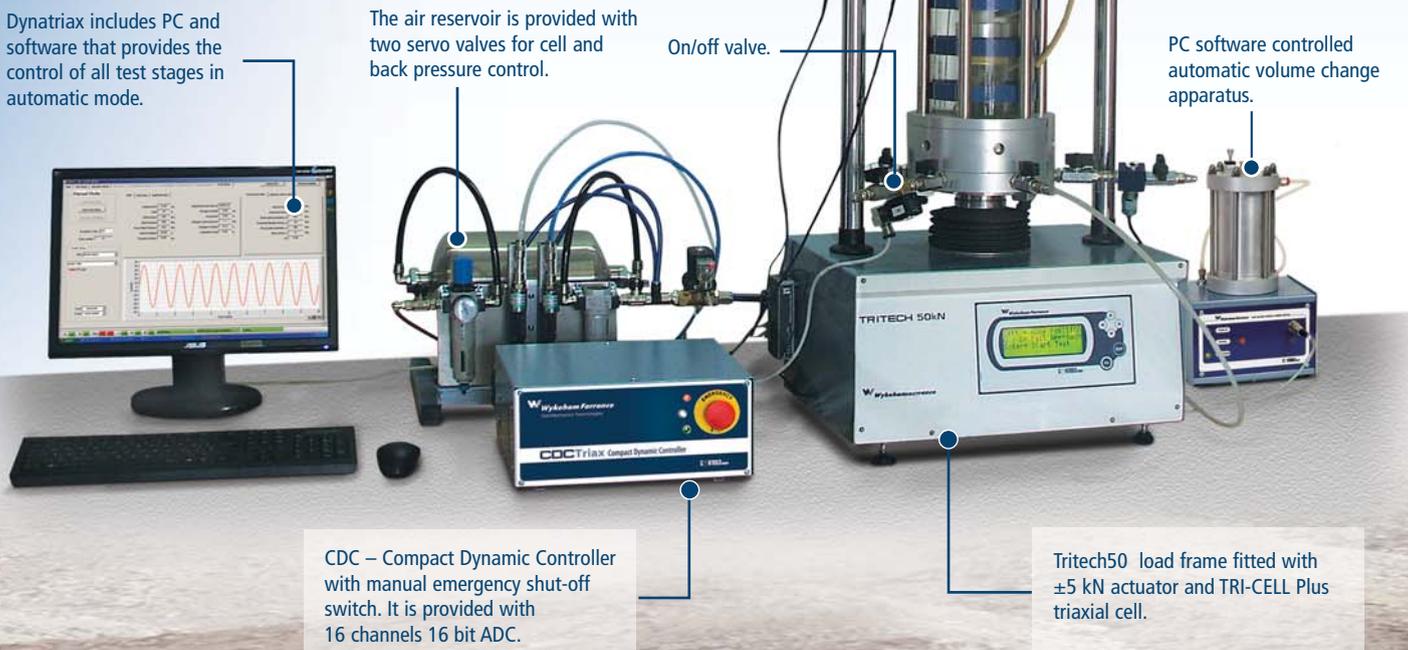
The pneumatic actuator applies the vertical cyclic load/displacement according to the set wave shape.

Servovalve for the vertical load control

The actuator locking system allows the user to easily skip from dynamic to static testing taking advantages of the load frame's maximum capacity.

Submersible load cell is used for accurate measurement, not affected by the friction of the ram and the cell pressure.

PC software controlled automatic volume change apparatus.



CDC – Compact Dynamic Controller with manual emergency shut-off switch. It is provided with 16 channels 16 bit ADC.

Tritech50 load frame fitted with ± 5 kN actuator and TRI-CELL Plus triaxial cell.

SOFTWARE

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

Saturation

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

Consolidation

- Isotropic consolidation with continuous volume change measurement

K_0 Consolidation

Vertical displacement loading with sample diameter control using either:

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

Stress path

- 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

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

Any or all of the above stages can be performed in 'automatic mode' where the test parameters are entered at the start of the test or stage and the software takes control of managing the stages using predefined criteria.

Cyclic loading

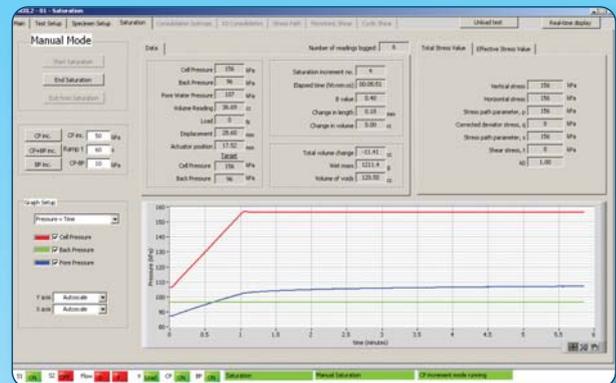
- ASTM D 5311** Load Controlled Cyclic Strength
- ASTM D 3999** Load Controlled Modulus & Damping
- ASTM D 3999** Displacement Controlled Modulus & Damping
- Non Standard** (single or multi cycle test)
- User defined or imported Waveshape**

Transducer limits

- An air shut-off valve can be programmed to be activated using user defined channel limits.

Calibration

- Digital calibration using linear fit, polynomial fit or linearization.
- Transducer verification option

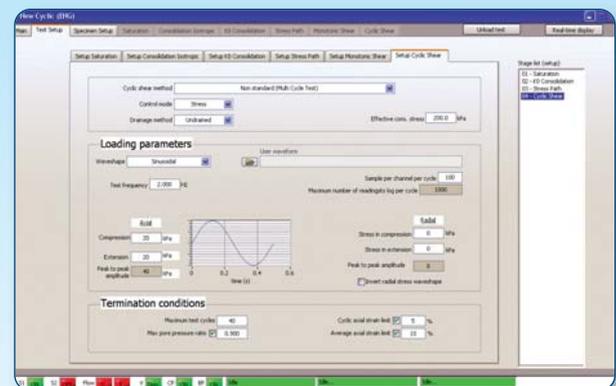


Saturation

This stage follows the incremental saturation as per BS 1377-1990 but is flexible and allows other methods to be used. The software will let you apply cell and back pressure increments with B value displayed in the cell pressure stage.

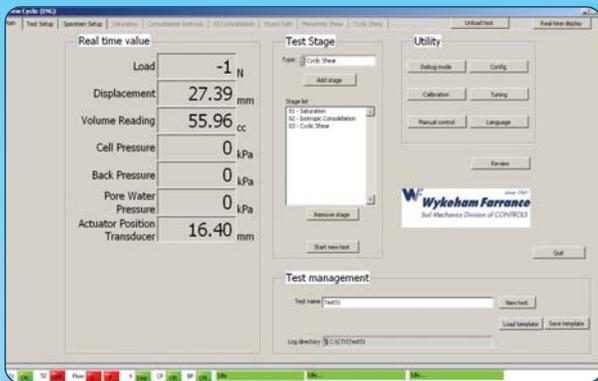
Graph displays

- Cell pressure against time
- Pore pressure against time
- Back pressure against time
- Volume change against time



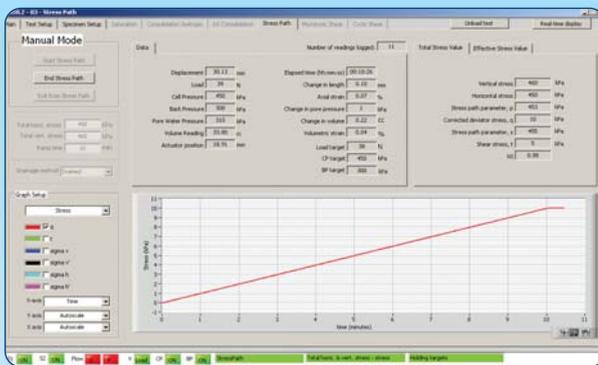
Selection of the cyclic stage and set up of the relevant parameters:

- Test method: ASTM D5311, D3999, non standard
- Waveshape: sinusoidal, triangle, square, user defined
- Frequency
- Peak to peak amplitude
- Type of control (stress, strain, force, displacement)
- Failure conditions: e.g. number of cycles, pore pressure ratio, strain limit



Set up of the different stages of the test

Saturation; isotropic consolidation; K_0 consolidation; Stress path; Cyclic shear; Monotonic shear.

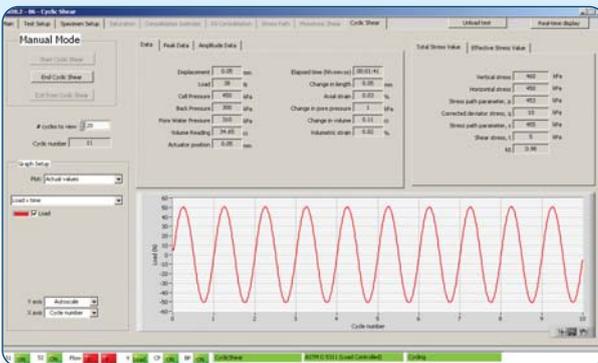


Stress path

This stage allows axial and radial stresses to be increased and decreased in incremental stages.

Available graphs

All transducer calculated; stresses and strains; stress path.

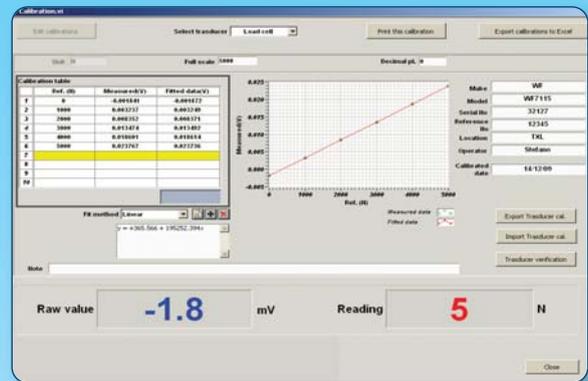


Cyclic stress controlled

The cyclic stage applies the specified cyclic loading to the specimen. This screen shows all the varying values during the cyclic stage.

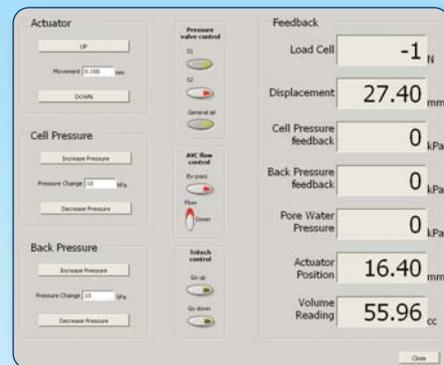
Available graphs

Real time transducers peak compression/extension and amplitude valves.



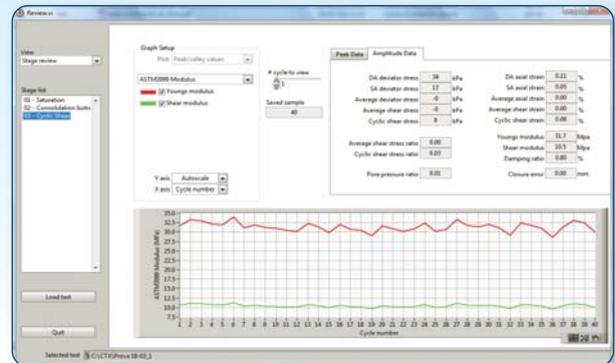
Transducer calibration

Transducers can be allocated and calibrated from the library in the test configuration.



Manual control procedure

The operator can manually manage the actuator, cell pressure, back pressure, volume change, electrovalves and, at the same time, monitor the transducer readings.



Cyclic shear

Young's modulus and shear modulus are monitored during the cyclic stage against the number of cycles.

DYNATRIAX

ORDERING INFORMATION

■ 31-WF7005

Dynatriax, dynamic triaxial basic system, ± 5 kN cyclic, on a 50 kN load machine. 110-240 V, 50-60 Hz, 1 ph.

■ 31-WF7010

Dynatriax, dynamic triaxial basic system, ± 5 kN cyclic, on a 100 kN load machine. 110-240 V, 50-60 Hz, 1 ph.

■ 31-WF7015

Dynatriax, dynamic triaxial basic system, ± 14 kN cyclic, on a 100 kN load machine. 110-240 V, 50-60 Hz, 1 ph.

■ 31-WF7000/UNS

Upgrading package for unsaturated soil testing.

The package includes the additional servovalve for air pressure control and the software to automatically perform the test stages using the axis translation method:

- Simultaneous and independent control of air pressure, pore water pressure and axial stress
- Performance of consolidation, saturation soil water curve and shear stages
- Test data recording for each stage

Triaxial cell and test accessories must be ordered separately.

■ 31-WF7000/RES

Upgrading software package for resilient modulus determination according to AASHTO T307.

The additional displacement transducer must be ordered separately.

Ask for our buyer's guide to
configure your testing system

ACCESSORIES

Triaxial cells (Tri-Cell Plus models)

The Tri-Cell Plus cells include outlets for on sample transducer cables or for bender elements.

They are also suitable for extension tests and can be equipped with submersible load cells.

► 28-WF4070/P

3400 kPa Tri-Cell Plus cell for 70 mm dia. samples.

► 28-WF4100/P

2000 kPa Tri-Cell Plus cell for 100 mm dia. samples.

► 28-WF4150/P

2000 kPa Tri-Cell Plus cell for 150 mm dia. samples.

Double triaxial cells for unsaturated tests

► 28-WF4170

Double triaxial cell for unsaturated tests on 70mm samples complete with 6 ports.

► 28-WF4171

Double triaxial cell for unsaturated tests on 100mm samples complete with 6 ports.



28-WF4100/P



Detail of the double wall of 28-WF4170 and 28-WF4171

Tri-Cell Plus accessories

Cell type nominal dia.	Maximum working pressure	Sample	Pedestal	Top cap with 2 drainage leads	Perspex base disc ⁽¹⁾	Coverion set ⁽²⁾	Top cap vacuum type ⁽³⁾
28-WF4070/P 70 mm	3400 kPa	38 mm	-	-	28-WF4033	28-WF4070/1	28-WF4032/V
		50 mm	-	-	28-WF4053	28-WF4070/2	28-WF4052/V
		70 mm	28-WF4071	28-WF4072	28-WF4072	-	28-WF4072/V
28-WF4100/P 100 mm	2000 kPa	50 mm	-	-	28-WF4053	28-WF4100/1	28-WF4052/V
		70 mm	-	-	28-WF4073	28-WF4100/2	28-WF4072/V
		100 mm	28-WF4101	28-WF4102	28-WF4103	-	28-WF4102/V
28-WF4150/P 150 mm	2000 kPa	100 mm	-	-	28-WF4103	28-WF4150/2	28-WF4102/V
		150 mm	28-WF4151	28-WF4152	28-WF4153	-	28-WF4152/V
		28-WF4170 70 mm	2000 kPa	70 mm	28-WF4170/1 ⁽⁴⁾	28-WF4170/2	28-WF4073
28-WF4171 100 mm	2000 kPa	100 mm	28-WF4171/1 ⁽⁴⁾	28-WF4171/2	28-WF4103	-	28-WF4171/V

(1) Only for UU tests - (2) Consisting of pedestal, top cap and drainage leads - (3) Required to perform extension test - (4) It includes 2 bar high air entry stone. Also 1, 5, 10, 15 bar stones capacity are available

Sample accessories

Sample size	Porous disc (pair)	Rubber membrane (pack of 10)	O ring (pack of 10)	Membrane stretcher	O ring placing tool	Two part split mould with vacuum attachment	Two part split former	Lateral filter drains (pack of 50)	Filter discs (pack of 100)	Hand sampler
38 mm	28-WF4034	28-WF4035	28-WF4036	28-WF4031/A	28-WF4031/B	28-WF4031/H	28-WF4031/D	28-WF4031/E	28-WF4031/F	28-WF4031/G
50 mm	28-WF4054	28-WF4055	28-WF4056	28-WF4051/A	28-WF4051/B	28-WF4051/H	28-WF4051/D	28-WF4051/E	28-WF4051/F	28-WF4051/G
70 mm	28-WF4074	28-WF4075	28-WF4076	28-WF4071/A	28-WF4071/B	28-WF4071/H	28-WF4071/D	28-WF4071/E	28-WF4071/F	28-WF4071/G
100 mm	28-WF4104	28-WF4105	28-WF4106	28-WF4101/A	28-WF4101/B	28-WF4101/H	28-WF4101/D	28-WF4101/E	28-WF4101/F	28-WF4101/G
150 mm	28-WF4154	28-WF4155	28-WF4156	28-WF4151/A	28-WF4151/B	28-WF4151/H	-	28-WF4151/E	28-WF4151/F	-

Submersible load cells

Designed to work inside the triaxial cell. The load measurement is highly accurate as it is not affected by the friction of the ram in the triaxial cell bush and cell pressure and by cell pressure.

- **31-WF7117**
Submersible load cell, 5 kN cap.
- **31-WF7118**
Submersible load cell, 10 kN cap.
- **31-WF7119**
Submersible load cell, 25 kN cap.



31-WF7117

Common Specifications
Overload capacity: 200%
Excitation voltage: 10 VDC
Hysteresis: 0.05% full scale

Water distribution panel

- **31-WF4335**
Water distribution panel, two pressure lines, complete with digital pressure gauge and hand pump.



31-WF4335

Bladder Air/Water pressure cylinder

- **28-WF4320**
Bladder air/water pressure cylinder for pressures up to 1000 kPa.



28-WF4320

Air compressor

- **86-D2015/A**
Air compressor, 10 bar max. pressure, 200 l capacity. Power: 5.5kW, 400 V, 50 Hz, 3 ph.

Transducers

- **31-WF7121**
LVDT linear transducer, ± 25 mm travel, (0,2% FSO accuracy).

- **28-WF6300**
Pressure transducer, 10 bar max.

- **28-WF6310**
De-airing block for pore pressure transducer.



28-WF6300 with 28-WF6310

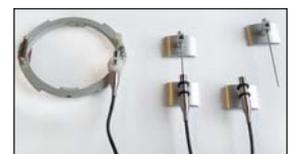
- **29-WF4412**
Automatic volume change device with remote controlled flow inversion. 100 cc capacity, 0.1 cc accuracy, 2000 kPa max. operating pressure.



29-WF4412

- **28-WF4079/K**
On sample transducer kit for 70 mm sample (with 2 linear and 1 radial transducers).

- **28-WF4109/K**
On sample transducer kit for 100 mm sample.



- **28-WF4159/K**
On sample transducer kit for 150 mm sample.

- **28-WF4159/M**
Mid height pore pressure range up to 1000 kPa.



APPLICATIONS

- liquefaction potential
- strength degradation due to cyclic loading
- shear modulus and damping ratio
- resilient modulus
- effects of blasting in mines and quarries
- effects of ocean waves on coastal and off shore structures

Causes of vibration or cyclic loadings



Wind



Earthquake



Rail track



Blasting



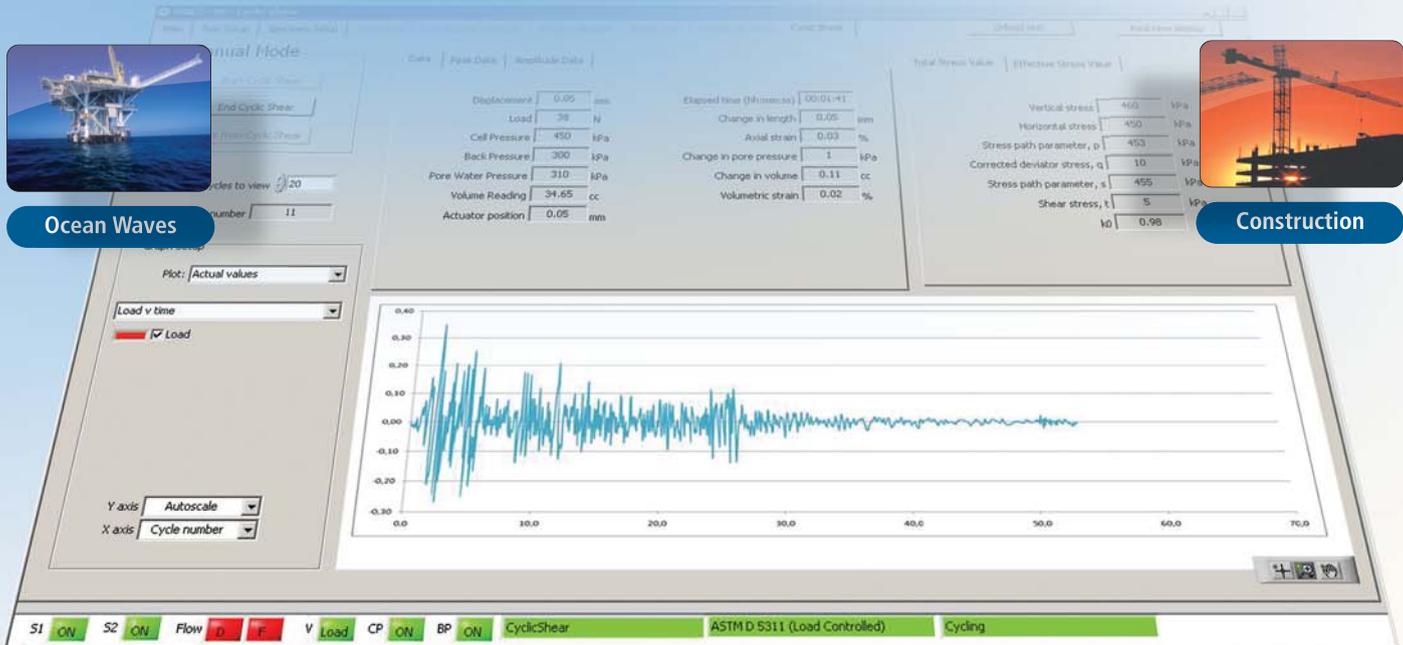
Traffic



Ocean Waves



Construction



DYNATRIAX as TANGRAM

The TANGRAM is a millenary Chinese dissection puzzle consisting of seven geometrical shapes (tans), "seven boards of skill". The seven pieces (often stored as a square) are used to make an almost infinite numbers of shapes. As with DYNATRIAX system, it is possible to set the base modules and replicate a wide range of applications.

CONTROLS S.R.L.
is certified to ISO 9001: 2008



CONTROLS S.R.L. is calibration Laboratory for compression machines accredited by SIT (member of European Co-operation for Accreditation)

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