GCTS is committed to designing accurate testing systems by integrating innovative software engineering with advanced hardware. GCTS systems perform at the highest levels of reliability, providing efficient systems that satisfy customer needs and expectations.

GCTS TESTING SYSTEMS

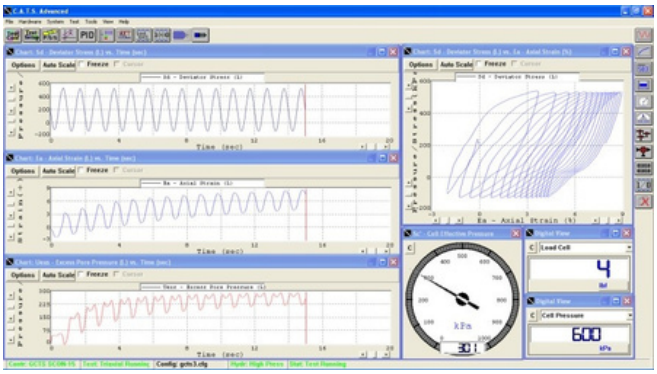
STX-300
Dynamic / Stress-Path Soil Triaxial System

- **Electro-Hydraulic digital servo control**
- **Dynamic and static triaxial tests**
- **Frequencies up to 30 Hz**
- **Specimen Diameter from 35 mm to 150 mm**
- **Axial loads up to 100 kN**
- **Cell Pressures up to 2,000 kPa**
- **Biaxial dynamic tests up to 5 Hz with synchronized loading**
- **Direct servo control of stress, strain (axial, radial, volumetric, etc.) or any other calculated variable**
- **Resilient Modulus, Bender Element & Unsaturated soil testing options available**
- **Meets ASTM D-3999 & D-5311 Standards**

DESCRIPTION

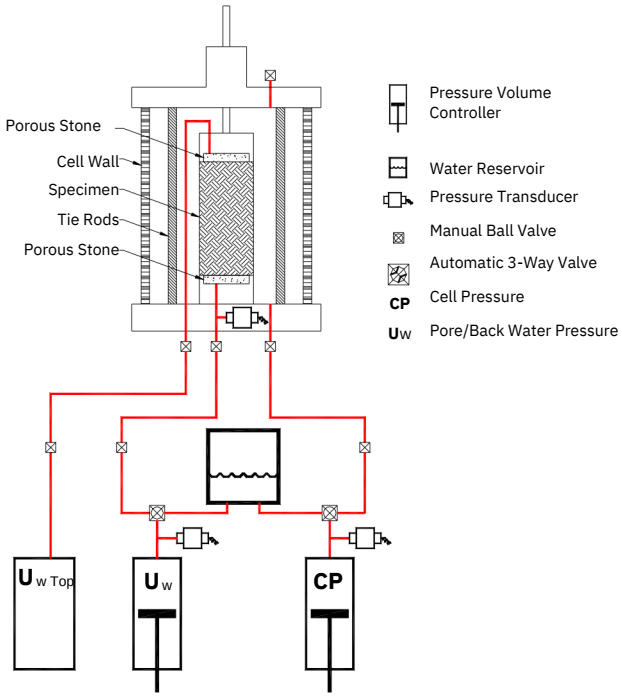
The STX-300 triaxial testing system is intended for performing dynamic tests for liquefaction, resilient modulus, cyclic strength, complex modulus, and other dynamic triaxial tests including synchronized cyclic axial and confining stress loading. This system also provides the necessary versatility to automatically perform conventional triaxial tests as well as advanced procedures such as stress or strain path.

The standard STX-300 system includes all the necessary hardware and software to automatically perform all triaxial stages including saturation, consolidation, and easily created cyclic and static customized test procedures. It allows creation of an unlimited variety of waveforms including user-generated profiles such as a digitized earthquake record. The program helps the user select the proper testing parameters and provides the necessary information required to automatically execute the desired test.



The Graphical User Interface helps minimize learning time and enables laboratory personnel to conduct more complex, but realistic, testing programs at substantially lower operating cost and also with minimal operator error.

This system includes a load frame that is relatively lightweight but highly stable and has a small tabletop footprint. The load frame consists of two large, stainless steel threaded columns with a hard-anodized aluminum cross head beam and a large, thick bottom plate for stability. The bottom plate is threaded for the two upright columns and for hold-down bolts to secure the triaxial cell. The stainless steel nuts on the frame columns can be used to easily adjust the height of the crosshead beam to accommodate variable specimen or cell heights. These frames can be configured with different flow capacity servo valves to obtain the required cyclic amplitudes. Performance charts printed below show the cyclic response of the standard and optional servo valves.



STX-300 Dynamic Triaxial System Schematic

The triaxial cell included with the STX-300 system is constructed of stainless steel. The standard unit features a see-through Plexiglas external cell wall. The advantages of the external cell wall (internal tie rods) are that after the specimen is completely ready for a test, the cell wall is lowered over the cell and fastenedinto place with minimum disturbance to the test sample. All the standard GCTS triaxial cells can accommodate smaller diameter specimens using optional platens. These triaxial cells accept specimens with a length of 2 to 2.5 times the diameter.

The standard STX-300 includes two pressure/volume controllers for applying the cell and back pressures. Each pressure/volume controller is housed inside a metal cabinet with casters that also include a 20 liter de-airing fluid reservoir, vacuum pump, precise analog gages, automatic ball valves, flow indicators, etc. making them very convenient and easy to operate. Pressure gauges provide a visual verification of confining and pore pressures. Convenient "quick-connect" fittings allow for easy connection of pressure lines and filling/draining the fluid reservoirs. Sight tubes are also available to show the available amount of fluid in each fluid circuit. Each pressure/volume controller intensifier has a pressure transducer and LVDT connected to them allowing for the servo control as a function of pressure, fluid volume control, or any other measured or calculated test parameter. With both pressure/volume controllers, advance tests such as stress/strain path, Ko, permeability, etc. can be easily performed. GCTS Pressure/Volume pumps use servo hydraulic controls that offer a fast reaction time and can apply synchronized cyclic axial and lateral stresses at high frequencies.

The STX-300 is operated with our fully integrated SCON-1500 digital signal conditioning/controller and the state-of-the-art CATS-TRX-SOIL, true 32-bit, Windows XP software. Conducting Triaxial tests have been greatly simplified by the incorporation of direct user programming of test calculated parameters in the units of interest (stress, strain, etc.) based on the specimen dimensions. Up to 20 test parameters are automatically defined and corrected taking into account such things as piston uplift force from confining pressure application and changes in specimen area during the test. These parameters are calculated in real time and are available for display, graph and/or control. In addition, CATS software allows you to define user defined parameters to obtain multiple sensor averages or corrections as a function of other inputs. Using calculated test parameters directly eliminates complex and lengthy pre-calculations to design test programs. This allows the user to concentrate on the material behavior rather than on the electronics and equipment operation.

The embedded microprocessor is capable of performing all test functions even if the Windows computer crashes. It provides automatic dynamic control mode switching between any connected transducer or calculated parameter ("bump-less transfer"). This controller also conditions all transducers used for triaxial testing and provides real time linearization of any input using high-order polynomials. This digital controller is capable of updating the control loop at up to 6 kHz required to control the loads for high frequency dynamic tests. The SCON-1500 has several adaptive compensation techniques to improve the control precision without user intervention. Controlling the actual axial stress (as oppose to the axial load) and use of the Peak and Valley compensation ensures the precision of the programmed waveform amplitude even after the specimen undergoes significant deformations or stiffness degradation. This is an important feature in order to maintain the desired cyclic amplitudes throughout the entire test.

Our system includes a 150,000 per second sampling rate with 16-bit (0.0015%) resolution and "sample-and-hold" Digital-to-Analog (A/D) Converter. The sample-and-hold ensures that the converted values from all attached sensors (load cells, deformation, etc.) represent a single instant in time eliminating any data skew from delays in the A/D converter. GCTS hardware-software interface includes both an analog anti-alias filter for high frequencies and a digital filter for lower frequencies. This configuration produces a very stable and precise signal measurement and control system as required to perform dynamic triaxial tests.

Any desired unit can be used for display or report test parameters and even allowing combining different unit systems. GCTS software also offers compatibility with network systems for monitoring or sending your test data directly to any computer connected to your network. Using a Windows network system in your lab facilitates transferring of your test data directly into other Windows programs such as Word or Excel for report generation as well as to easily backup your important test results.

Together with GCTS excellent support from our highly qualified and experienced staff, we are sure to provide the best option and price-performance value.

SPECIFICATIONS

	STX-100	STX-200	STX-300
Load Frame			
Model:	FRM-20-1	FRM-50-3	FRM-100-5
Load capacity:	22 kN	45 kN	100 kN
Stroke:	50 mm	100 mm	100 mm
Servo Valve:	11 LPM	11 LPM	19 LPM
Standard HPS:	3 H.P.	3 H.P.	10 H.P.
Max. vertical opening:	765 mm	900 mm	1,050 mm
Horizontal daylight opening:	340 mm	355 mm	405 mm
Triaxial Cell			
Model: Max. specimen diameter:	TRX-100 75 mm	TRX-200 100 mm	TRX-300 150 mm
Loading piston diameter:	15.9 mm	25.4 mm	25.4 mm
Transducers			
Frame LVDT:	50 mm	100 mm	100 mm
External load cell:	±22 kN	±45 kN	±100 kN
Internal load cell:	±2.2 kN	±8 kN	±22 kN
Shipping			
Std. volume:	2.3 m3	2.6 m3	3.0 m3
Std s weight:	750 kg	980 kg	1,200 kg

1.1) Loading Frame
Two column vertical standing assembly with threaded columns for cross-head adjustment. Includes manifold including on/high pressure control solenoid and accumulator to minimize pressure ripples, and high-frequency two-stage electro-hydraulic servo valve.

1.2) Hydraulic Pump System
21 MPa variable volume constant pressure pump. large reservoir, oil temperature indicator, pressure and return filters, pressure gage, valves, thermal and low fluid level shut off protection, heat exchanger, hydraulic hoses (10 m. long), accumulator, filler strainer, drain port and motor starter. Includes computer low/high/off remote controls, oil temperature sensor, level sensor, and 3-phase power monitoring sensor for computer diagnostics and interlocks. Voltage: 208, 230, 380 or 460 V / 50 or 60 Hz / 3 phase (please specify electrical power and hydraulic hoses length at time of ordering).

1.3) Triaxial Cell
Three-column stainless steel construction with external acrylic plastic cell wall. 1,000 kPa lateral confining pressure capacity. Includes lines for top and bottom specimen drainage, stainless steel loading piston, ball bushing guide, low-friction (under 10 N) graphite seal, and sealed feed-through connectors to accommodate different type of sensors such as load cells, LVDTs, ultrasonic transducers, etc. Also includes plugs for sealing the feed-through connectors while not in use. Accepts samples with a length of 2.0 to 2.5 times the diameter. Supplied with valves, fittings and nylon tubing. Optional 2,000 kPa pressure capacity available.

1.4) Test Specimen Accesories
Set of test specimen accessories and end platens with top and bottom pore water pressure ports including the following:

- (1) Top and bottom platens with embedded porous stones.
- (1) Spherical seat loading connection set.
- (1) Rigid loading connection for stress reversal.
- (1) Holder plate for two external LVDTs.
- (12) Latex membranes.
- (2) Set of O-rings for sealing membranes to platens

1.5) Submersible load cell
Water submersible internal load cell with 0.15% linearity (see table for transducer range)

1.6) SR-PR-OM-1000 Pore Pressure Transducer
Triaxial cell base pore pressure transducer 1,000 kPa range. 0.25% Linearity. Includes de-air/purge port. Mounted on triaxial cell base.

1.7) PCP-2000 Pressure Control Panel
Pressure/Volume Control System for testing of saturated soil specimens. Includes cabinet mounted on casters to house the confining pressure and back pressure / volume controllers and control panel. Also includes the following:

- 20 liter evacuation chamber with fine spray nozzle and vacuum/vent port for preparing and storing de-aired water.
- Venturi vacuum pump, vacuum gage and regulator for applying low vacuum to evacuation chamber.
- Pressure test gauge with (±0.25% accuracy), regulator, and air/water interface for manual control of specimen top back pressure.
- All necessary plumbing and zero-volume-change valves.

1.8) PVC-150-C Cell Pressure/Volume Controller
Cell Pressure/Volume computer servo-controlled pump. 1,000 kPa pressure and 800 cc volume capacity. Includes hydraulic servo valve, pressure transducer with 0.1 kPa resolution, and volume change transducer with 0.02 cc resolution for direct measurement of pressure and volume. Capable of applying synchronized cyclic wave forms at up 10 Hertz. Optional 2,000 kPa pressure capacity available.

1.9) PVC-100 Pore Pressure/Volume Controller

Pore Pressure/Volume computer servo-controlled pump. 1,000 kPa pressure and 300 cc volume capacity. Includes hydraulic servo valve, pressure transducer with 0.1 kPa resolution, and volume change transducer with 0.01 cc resolution for direct measurement of pressure and volume. Capable of applying synchronized cyclic wave forms at up 10 Hertz. Optional 2,000 kPa pressure capacity available.

1.10) SCON-1500 DIGITAL SERVO CONTROLLER AND ACQUISITION SYSTEM

Microprocessor based digital servo controller, function generator, signal conditioning, data acquisition, and digital I/O unit. Advanced servo control from any system sensor with "on-the-fly bump-less" transfer switching between any connected transducer or calculated input. Can be configured to read up to 8 transducers or inputs and control up to 4 outputs. Includes 8 DSB-111 Universal Signal Conditioning boards and 3 DSB-122 Servo Amplifier Boards plus all necessary cables (see SCON-1500 brochure for full specifications).

1.11) WIN-CATS-ADV

32-bit Windows 98/2000/NT/XP software for advanced digital servo control from any system sensor or calculated channel with "on-the-fly" bump-less transfer. Includes calculated channels for stress, strain, etc., and user defined equations with the following specifications:

- Third degree polynomial sensor linearization in real time.
- Ability to define user defined inputs as a function of other inputs and correct by another input via a third degree polynomial to view or control in real time.
- Configurable unit library to automatically perform unit conversions.
- Linear, log, and semi-log plotting capability with user specified plot parameters.
- Unlimited user configurable view tools (graphs, meters, gages, bars, etc.)
- User defined procedures with up to 100 stages.
- Timed, Level Crossing, and Peak/Valley data acquisition modes.

** See WIN-CATS-ADV brochure for full specifications **

1.12) WIN-TRX-SOIL (TRX-ADV)

Advanced Triaxial test module to automatically perform conventional triaxial static tests (UU, CU, and CD) as well as other advanced tests such as Multi-Stage, Stress/Strain-Path, Ko-Consolidation, etc. Includes multiple procedures for automatic back pressure saturation, consolidation, and static shear loading with unlimited stages.

1.13) WIN-TRX-DYNAMIC

A Triaxial dynamic module to perform simple cyclic test such as liquefaction, modulus measurement, cyclic strength, etc. includes sine, triangular and rectangular wave forms.

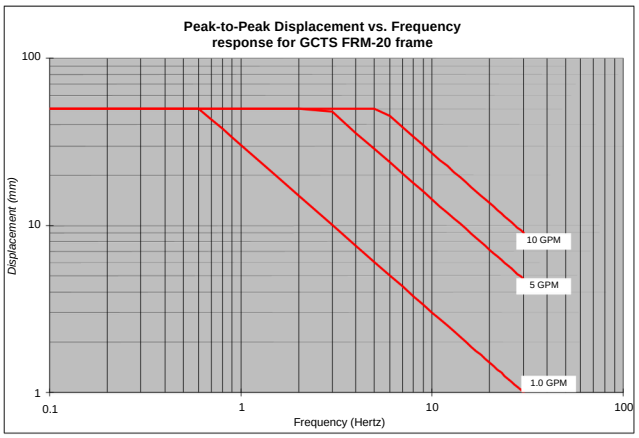
1.14) Computer

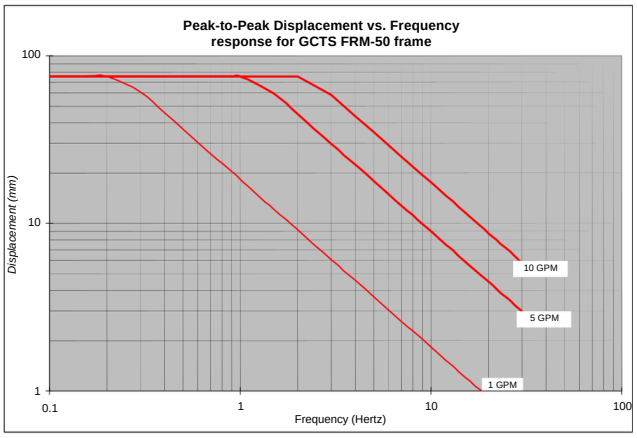
Computer with Windows XP Operating System to control and execute the test automatically (contact GCTS for current specifications).

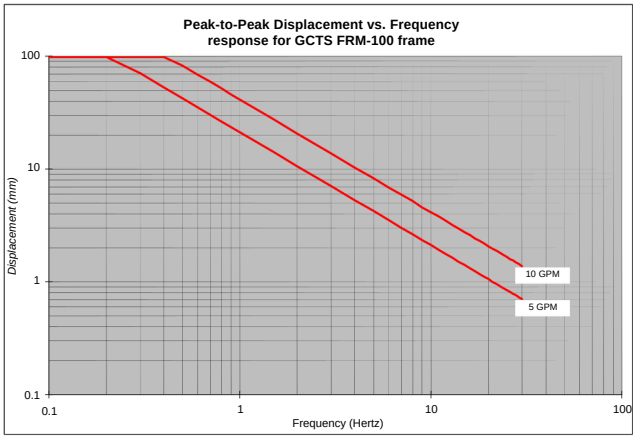
OPTIONS

2) Compaction Split Molds

Forming mold/jacket stretcher for specimens with a height of 2.0 times the diameter. Anodized aluminum construction with vacuum ports for membrane expansion. Available sizes for 70 mm (2.8”), 100 mm (4”), and 150 mm (6”) diameter specimens.







3) Accessories for Other Diameter Test Specimen

Set of test specimen accessories and end platens with pore water pressure ports for smaller specimen diameters. Standard & Custom size diameters available.

4) Bender Element Ultrasonic Transducers

Set of compression mode and shear mode (bender element) wave transducer platens with 200 kHz frequency compression crystal.

5) Unsaturated Soil Testing Option

Additional hardware and software to enable system to perform unsaturated soils triaxial tests.

6) Resilient Modulus Upgrade

Additional hardware and software to enable system to perform Resilient Modulus triaxial tests according to AASHTO and NCHRP procedures dislocation of the coarse aggregate when drilling. It offers both,