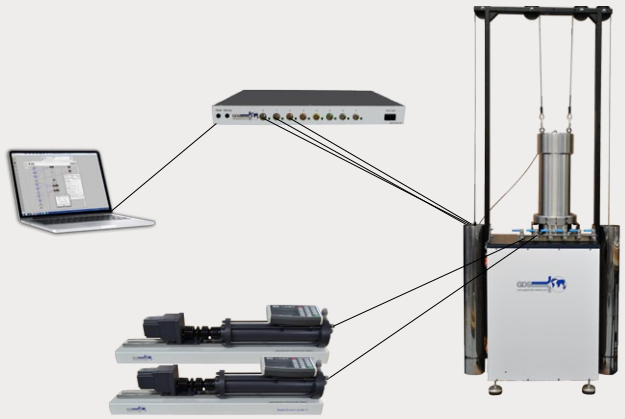


Advanced Dynamic Triaxial Testing System
(DYNTTS-5)

Overview: The Advanced Dynamic Triaxial Testing System (DYNTTS) is a high-end testing apparatus combining a triaxial cell with a dynamic actuator capable of applying load, deformation and stresses at up to 5Hz.

The axial axis is screw-driven from an integral base unit housing the motor drive. Axial force and axial deformation are applied through the base of the cell.

Key Features:	Benefits to the User:
High accuracy electro-mechanical control:	The DYNTTS system is capable of very small strain static tests through to large strain dynamic tests.
Interchangeable load cells:	Allows user to accommodate very soft to very stiff soils with ranges of 1, 2, 4, 8, 10, 16, 25, 40 and 60kN.
In-built balanced ram (up to 5Hz systems):	Keeps cell pressure constant during cycling, meaning a dynamic pressure controller is not required (unless dynamic cycling of cell pressure is required).
Interchangeable pedestals and triaxial extension top caps:	Allows testing of 38, 50 and 70mm diameter test specimens in the same cell.
Direct closed loop of axial displacement & axial force:	Accurate control in either axial displacement or axial force mode.
Adaptive Control as Standard:	Adaptive Control significantly improves the dynamic load control performance of an apparatus, leading to increased testing precision.

Tests that can be Performed:

Consolidated drained (CD), consolidated undrained (CU), consolidation (Triaxial), dynamic cyclic loading of samples under either load or strain, slow cyclic testing, quasi-satic (low speed/creep) tests, stress paths, K-Zero and user defined waveforms.

Upgrade Options:

Bender element system (Vertical, Horizontal, S and P waves), Hall Effect Local Strain, LVDT local strain, unsaturated testing and temperature controlled testing.

Technical Specification:

Actuators:	High accuracy electromechanical
Axial Force Accuracy:	<0.1%
Axial Force Resolution:	24bit (i.e. <0.4N for 10kN load cell, <1.5N for 40kN load cell)
Axial Load (kN):	40
Displacement Range (mm) & Resolution:	100 & 0.20um
Operating Frequency (Hz): **Load Range (kN):**	5Hz - 40kN
Cell Pressure Range (Static):	5MPa with max sample size 70mm
Speed of Measurement and Control:	5, 16kHz
Sample Sizes (mm):	38, 50, 70

Systems Elements & Options

The fundamental system hardware elements are shown in Fig. 1 below. The actual hardware used may be chosen to suit your testing and budgetary requirements. The more common arrangements are as follows:

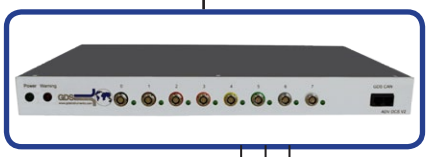
Advanced Digital Control System (ADVDCS V2)

The GDS dynamic systems are all based around the high speed GDS Digital Control System (GDSDCS) with closed-loop feedback of displacement and load.

With 24 bit data acquisition (A/D) and 16 bit control output (D/A), the GDSDCS runs at a control frequency of 16kHz per channel. This means that when running at 16Hz the system uses 1000 control points per cycle. When running at 1Hz, it uses 10000.

GDSLAB Software

The GDSLAB control and acquisition software is a highly developed, yet extremely flexible software platform. Starting with the Kernel module and the ability to perform data acquisition, additional modules are added for your testing requirements.



Pore Pressure (kPa)
Axial Strain (mm)
Load Cell (kN)

Load frame control

Cell pressure / volume

Back pressure / volume

Note: Connection via USB

Pressure Volume / Controllers

The Advanced Pressure / Volume Controller (ADVDPC) with pressure ranges of 5MPa, USB connectivity and 200cc volumetric capacity.

Frequency Range (Hz)

- 5.

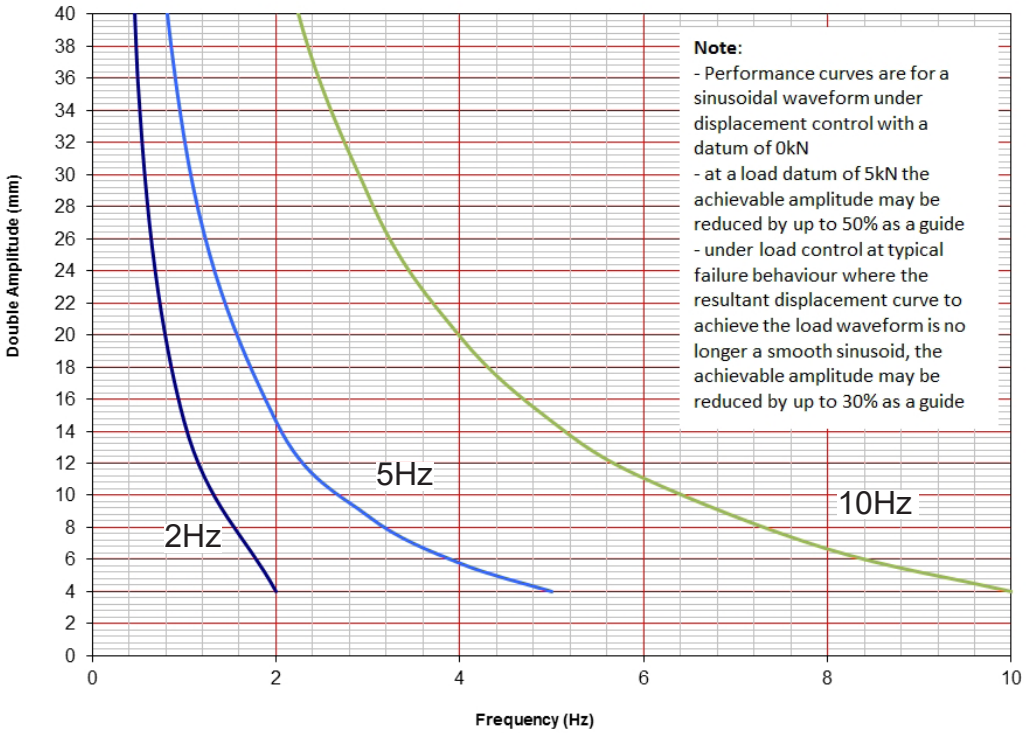
Load Range (kN)

- 40

Specimen Sizes (mm)

- 38, 50, 70, other sizes available upon request.

Fig. 2 Typical system behaviour showing frequency and amplitude for 2Hz/10kN, 5Hz/10kN and 10Hz/10kN systems

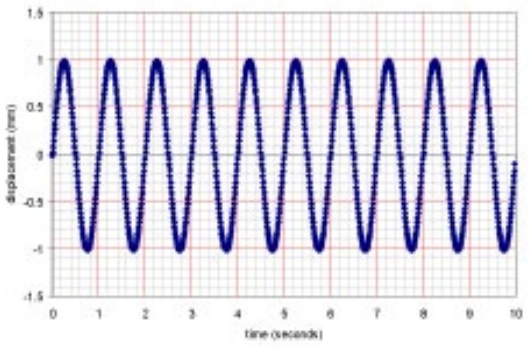


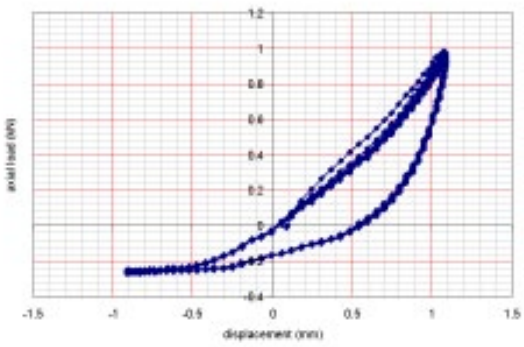
Frequency	2Hz - Double Amplitude (mm)	5Hz - Double Amplitude (mm)	10Hz - Double Amplitude (mm)
0.1	100.0	100.0	100.0
0.2	99.6	100.0	100.0
0.5	35.8	100.0	100.0
1	14.6	32.3	100.0
2	4.0	14.6	46.4
3		8.7	28.8
4		5.8	19.9
5		4.0	14.6
6			11.1
8			6.7
10			4.0

Typical Test Results Showing Displacement Control at 1Hz

Axial displacement feedback control

Frequency (Hz): 1.00 Peak to peak (mm): 2.000 Radial stress (kPa): 200.0





Adaptive Control - As Standard

Adaptive Control is a cutting edge technology that significantly improves the dynamic load control performance of an apparatus, leading to increased testing precision.

The GDS Adaptive Control firmware algorithm automatically adjusts the control gain values based on the observed specimen stiffness, removing the need for the user to enter a specimen stiffness value prior to the test. This has the additional advantage of ensuring specimen stiffness changes during a test are also dealt with correctly. When testing using an apparatus running GDS Adaptive Control, the firmware automatically optimises the control gains' values based on variations in soil stiffness as a cyclic test stage progresses, enabling a consistent loading amplitude to be applied to the test specimen. This marks a significant improvement over traditional PID closed-loop systems which, especially when testing multiple specimens of varying stiffness, require the user to re-tune the system before each dynamic cyclic test as well as risk under-performance when specimen stiffness changes during loading.

GDSLAB Control Software

GDSLAB is the control and data acquisition software for geotechnical laboratory applications. GDSLAB starts with a core application known as the kernel. The GDSLAB kernel allows for data acquisition from your hardware, but no test control. Simply add the appropriate module or modules to complete the test suite functionality you require. GDSLAB is compatible with all existing GDS equipment and furthermore key hardware from other manufacturers.

Required Operating System: Windows 7 SP1 or higher (We strongly recommend that Windows is fully up to date and running the latest Service Pack/Version available). Recommended PC Specification: 2GHz processor, 4GB Ram, 64Bit Operating System and USB connectivity. Note: GDS software can run on lower spec PC's however; performance and processing of data may be affected.

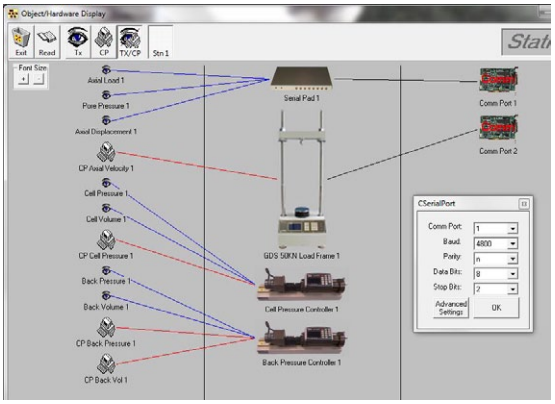


Fig. 5 A typical set-up screen in GDSLAB

Why Buy GDS?

GDS have supplied equipment to over 84% of the world's top 50 Universities:

GDS have supplied equipment to over 84% of the world's top 50 Universities who specialise in Civil & Structural Engineering, according to the "QS World University Ranking 2019" report.

GDS also work with many commercial laboratories including BGC Canada, Fugro, GEO, Geolabs, Geoteko, Golder Associates, Inpijn Blokpoel, Klonn Crippen, MEG Consulting, Multiconsult, Statens Vegvesen, NGI, Ramboll, Russell Geotechnical Innovations Ltd, SA Geolabs, SGS, Wiertsema and Partners to name a few.

TOP 50

Would you recommend GDS equipment to your colleague, friend or associate?

100% of our customers answered "YES"

Results from our post-delivery survey asked customers for feedback on their delivery, installation (if applicable), supporting documentation, apparatus and overall satisfaction with GDS. The survey ran for two years.

Made in the UK:

All GDS products are designed, manufactured and assembled in the UK at our offices in Hook. All products are quality assured before they are dispatched.

GDS are an ISO9001:2015 accredited company. The scope of this certificate applies to the approved quality administration systems relating to the "Manufacture of Laboratory and Field Testing Equipment".

40 YEARS OF BRITISH INNOVATION

Extended Warranties:

All GDS apparatus are covered by a 12 month manufacturers warranty. In addition to the standard warranty, GDS offer comprehensive extended warranties for 12, 24 and 36 months, for peace of mind against any repairs in the future. The extended warranties can be purchased at any time during the first 12 months of ownership.

GDS Training & Installation:

All installations & training are carried out by qualified engineers. A GDS engineer is assigned to each order throughout the sales process. They will quality assure the apparatus prior to shipping, if installation has been purchased, install the apparatus on the customers site & provide the training.

Technical Support:

GDS understand the need for ongoing after sales support, so much so that they have their own dedicated customer support centre. Alongside their support centre GDS use a variety of additional support methods including remote PC support, product helpsheets, video tutorials, email and telephone support.