

# 2022

# GDS



LABORATORY SYSTEMS  
**FOR SOIL AND ROCK**

GDS INSTRUMENTS PRODUCT CATALOGUE 2022

GDS Instruments designs, develops and manufactures material testing machines and software used for the computer-controlled testing of soils and rocks.

#### COMMERCIAL TESTING SOLUTIONS

GDS work with commercial testing laboratories based all over the world. From large international companies with multiple sites, through to independent laboratories. GDS have a good understanding of the tendering process and project constraints that commercial laboratories have to work with and can provide support and guidance through the process to make your investment in apparatus the most effective.

#### RESEARCH TESTING SOLUTIONS

GDS work with leading Universities around the world, it is estimated that at least 1000 PhD's have been obtained through the direct use of GDS equipment. QS Quacquarelli Symonds is the world's leading provider of services, analytics, and insight to the global higher education sector. Their research is published on their flagship website [www.topuniversities.com](http://www.topuniversities.com). On examining their list of the top 50 Engineering (Civil & Structural) Universities, GDS had supplied apparatus to 86% of those on the list.

# WELCOME

## DEAR READER

Welcome to our 2022 brochure. With the geotechnical industry continuing to expand, we are delighted to be supporting some of the largest geotechnical projects the world has ever seen. Infrastructure development required to support the overall population growth continues to march forwards at a tremendous pace. It is particularly enriching to be heavily involved with projects such as the site investigation and foundation design for the many offshore wind projects around the world, which feels as though we are playing our part towards the development of a sustainable planet. As I write this, the COP26 conference is ongoing in Glasgow, Scotland, and I think we are all waiting with baited breath hoping for some strong government action towards green energy, which is likely to mean even more work for the geotechnical and civil engineering community.

For 2022 we are excited about meeting more of our customers again, whether that be in laboratories performing training, or at exhibitions and conferences, the human contact has been sorely missed.

We have completed our factory expansion and are setup to support our customers now and in years to come. We have also been nominated for an award in the UK that celebrates companies that take significant steps towards positive staff wellness. Staff wellness is something we take very seriously at GDS, and I sincerely hope it has the positive effect of generally translating into good service and support, and an all-round good experience when dealing with GDS. It is definitely what we strive for.



**Karl Snelling**, Managing Director  
(GDS Won Judges Scientific 'Company of the Year' for 2020)

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 [linkedin.com/company/gds-instruments](https://www.linkedin.com/company/gds-instruments)

 [GDS Instruments](https://www.youtube.com/GDSInstruments)



# COMMERCIAL TESTING



Structural Soils  
Laboratory, Bristol.

## ACCURACY & EXPERTISE

### CUSTOMER PROJECTS

GDS apparatus has been used in many commercial developments including the Three Gorges Dam in China, Millau Viaduct in France, Vasco da Gama Bridge in Portugal, Terminal Five at Heathrow and the High Speed Crossrail links in the UK.

### TENDERING

GDS can provide services to support the tendering process, whether this is liaising with the end-user, providing service levels agreements or advising on laboratory layout.

### LABORATORY APPARATUS

GDS' apparatus is ideal for the commercial laboratory. Accuracy of testing reduces build costs, automation of tests reduces the time of a test, interchangeable system parts and multiple system upgrades give the apparatus flexibility.

### STANDARDS

GDS apparatus adhere to many industry standards, including AASHTO, AS, ASTM, BS, CEN ISO/TS and JGS.

#### ACCURACY IN TESTING

All GDS apparatus are designed, built and assembled in the UK. GDS do not compromise on build quality, ensuring the results from our apparatus are accurate every time. Accurate consistent results are key to reducing foundation / construction costs in the early phases of any project.

All GDS apparatus are automated, meaning tests can be set-up to run each phase without user input, whilst all data is recorded in our software. Interchangeable system parts including loadcells, topcaps and pedestals allow apparatus to be used for a multitude of tests. Most systems can be upgraded to allow for small strain measurement, unsaturated testing and temperature control.

GDS' apparatus is used by some of the largest and smallest commercial testing companies in the world and continues to lead the way in apparatus for commercial companies.

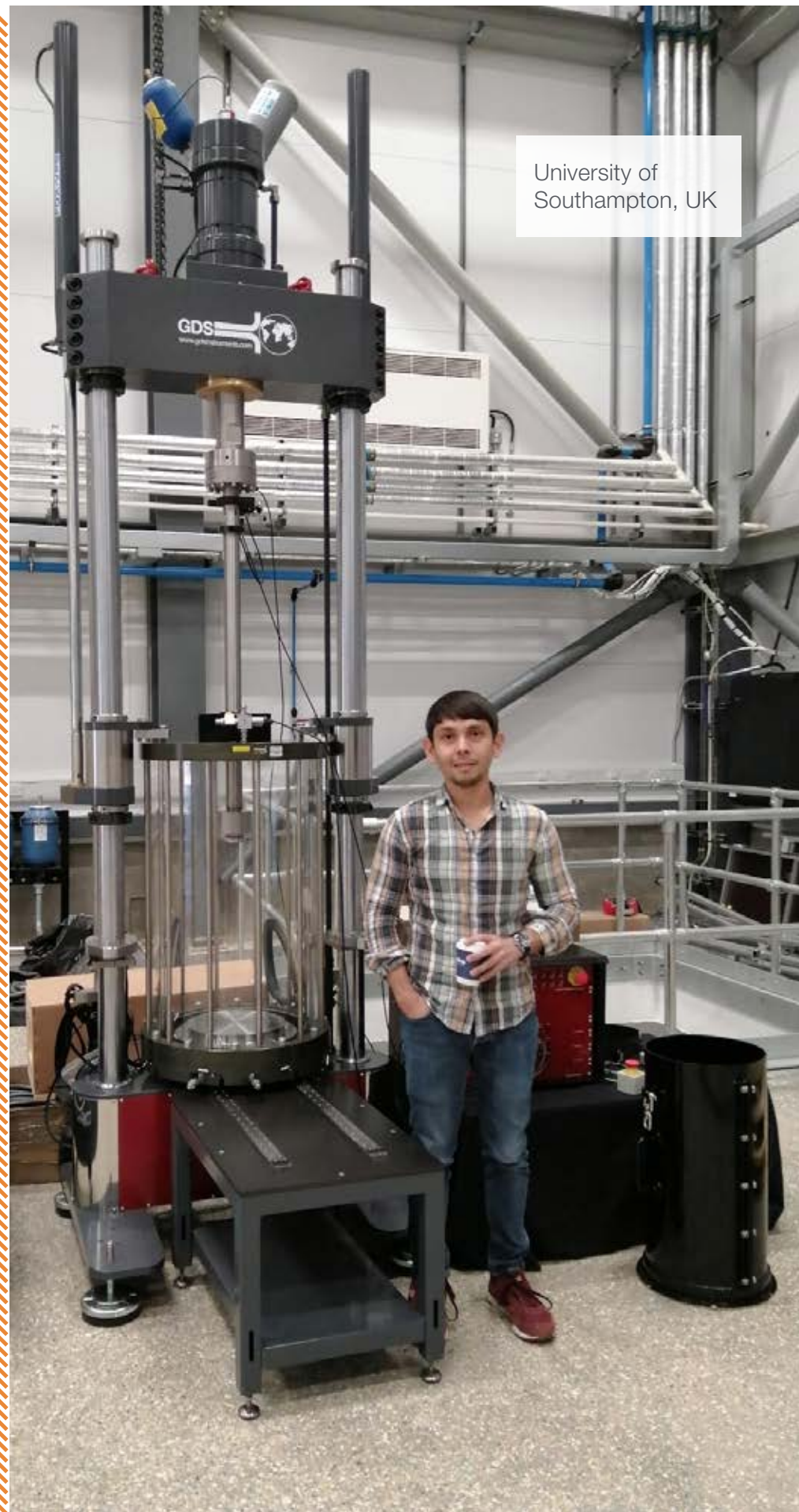
#### EXPERTISE FOR COMMERCIAL MARKETS

GDS apparatus continues to be used for infrastructure projects around the world, from renewable energy projects such as offshore windfarms to tailing storage design. As commercial laboratories invest in more advanced apparatus, GDS have developed their range of products to suit the specific requirements faced by commercial laboratories. In fact many of our products have been revised/designed based on feedback from our customers.

GDS are well known for their ongoing technical support, in fact they pride themselves on it. Service Level Agreements for technical support and maintenance are available and with a network of agents in over 40 countries, can provide local support if required. With remote and on-site installations available GDS can make sure your laboratories up and running as soon as possible.



# RESEARCH TESTING



University of  
Southampton, UK

## EDUCATION & RESEARCH



University of  
Washington, USA

GDS has been at the forefront of research testing systems since it started producing the automated stress path system back in 1979. It is estimated that GDS products have been used to help achieve over 1000 Phd's. The simple nature of use of the pressure/volume controllers, and the fact that a complete stress path system can be used on a bench top without the need for compressed air, provides a quiet, stand alone system that is ideal for teaching students.

The flexible nature of the GDS systems also means that each system can easily be upgraded with appropriate transducers and software where necessary to provide a system that is capable of being used for post graduate research. "Back in 1996 when I was doing my MSc in geotechnical engineering, we performed a number of triaxial tests as part of our labs which included a stress path test and a K0 test. I specifically remember the system was using some very old GDS pressure controllers that the University had obviously been using for many years.

Sometimes we ran tests with the assistance of software, sometimes we ran tests manually (where it was considered important that we fully understood the methods and should not allow the software to do the work for us!). These controllers were used at the University of Surrey for research, undergraduate teaching and for MSc labs." Karl Snelling, MD of GDS Instruments.

At GDS our experienced engineers are on hand to assist with any technical issues. The technical support is a function of the Geotechnical Systems Engineers, with installations and Quality Assurance (on equipment prior to shipping) making up the other areas of their roles. As part of our technical support we can provide remote support where necessary which has proved to be a valuable tool in resolving those more difficult technical issues in a timely manner.



# STATIC TRIAXIAL TESTING

GDS IS A SPECIALIST IN STATIC TRIAXIAL TEST SYSTEMS, OFFERING CONFIGURATIONS SUITABLE FOR DAY-TO-DAY COMMERCIAL TESTING UP TO ADVANCED RESEARCH WORK.

The triaxial test is one of the most versatile and widely performed geotechnical laboratory tests, allowing the shear strength and stiffness of soil and rock to be determined for use in geotechnical design. GDS has a multitude of systems available for conducting static triaxial tests, some of which are outlined below.

**TRIAXIAL AUTOMATED SYSTEM (GDSTAS)** is a load frame-based system wherein the axial stress/deformation is applied by a load frame. This is one of the most configurable systems in the GDS range. By choosing the load frame, pressure/volume controllers and triaxial cell capacity, the system can be configured for testing soft soils right up to high pressure rock tests. The lower capacities (50kN/2MPa) are generally the system of choice for commercial laboratories, with the upper range system (1MN-64MPa) the choice for rock mechanics laboratories. A heating and cooling system can also be added to the GDSTAS to enable temperature control – see the Temperature Control Testing section of this brochure for more information.

**TRIAXIAL TESTING SYSTEM (GDSTTS)** is the original automated stress path system created by GDS, using a Bishop and Wesley hydraulically actuated triaxial cell. Axial

stress is applied directly as a pressure through a hydraulically driven piston, it is a truly stress-controlled system. This system, like the GDSTAS, can be configured to include heating and cooling control – see the Temperature Control Testing section of this brochure for more information.

**VIRTUAL INFINITE STIFFNESS LOAD FRAME (GDSVIS)** is the premier high capacity load frame in the GDS range. Exclusive to GDS, the GDSVIS is an extremely stiff load frame, and in addition allows the axial loading system to operate as though it has infinite stiffness (zero system compliance) via a stiffness calibration/adjustment placed in the GDSVIS firmware. The GDSVIS comes in a range of load capacities up to 500kN and is suitable for testing high strength and/or stiffness materials, due to the high machine stiffness/low compliance (reduced machine ‘spring back’ for sudden failures at high load), as well as large diameter specimens.

## KEY FEATURES

- Each system may be configured to the customer’s test specification and budget.
- Automated system control and data acquisition via GDSLAB software.
- Self-contained electro-mechanical systems, with no requirement for compressed air.
- Compatible with other manufacturers’ products.
- Options to install localised pressure and deformation measurement transducers.
- Option to include bender elements and test unsaturated soils.

VIEW ALL PRODUCTS ▶ [www.gdsinstruments.com/statictriaxial](http://www.gdsinstruments.com/statictriaxial)

# STATIC SYSTEMS

## TRIAXIAL AUTOMATED SYSTEM



### PRODUCT CODE: GDSTAS

TECHNICAL SPECIFICATION:	
Load Range:	10, 50, 64, 128, 256, 500, 1000kN
Cell Pressure Range:	2, 3.5, 4, 20, 64MPa
Sample Size: (Frame & Cell Dependant)	38, 39.1, 50, 54, 61.8, 63.5, 70, 75, 76, 80, 100, 101, 150, 300mm

### PRODUCT FEATURES

- Can be configured to the user’s exact specification and budget.
- Software directly controls the system hardware, in addition to managing all data acquisition. Automated control allows tests to proceed continuously.
- User’s existing hardware may be incorporated with GDS equipment to create a full testing system, saving capital expenditure.

## TRIAXIAL TESTING SYSTEM



### PRODUCT CODE: GDSTTS

TECHNICAL SPECIFICATION:	
Load & Pressure Ranges:	2MPa: 7, 25kN 10MPa: 100kN
Sample Size:	38, 39.1, 50, 61.8, 70, 100, 101mm

### PRODUCT FEATURES

- The Bishop and Wesley cell is designed specifically for stress path testing. Direct axial stress application means greater accuracy for stress control.
- Users can choose the transducers, pressure controllers, and triaxial cell to build their ideal set-up. Existing hardware may also be incorporated into the system.
- Additional transducers, software test modules, and options to perform bender element and unsaturated soil tests ensures the system is future-proof.

## TRIAXIAL AUTOMATED SYSTEM FEATURING GDSVIS LOAD FRAME



### PRODUCT CODE: GDSVIS

TECHNICAL SPECIFICATION:	
Load Range:	100, 250, 400, 500kN
Cell Pressure Range:	2, 3.5, 4, 20, 64MPa
Sample Size:	38, 50, 54, 70, 76, 100, 150mm

### PRODUCT FEATURES

- Calibrated to provide precise load-deformation data across the entire load range of the frames.
- Feedback control and continuous display of axial load and platen displacement to allow simple and confident control of force and displacement.
- Automatic correction for system compliance, which is a common cause of error when estimating test specimen stiffness.



CONSTRUCTION

# DYNAMIC TRIAXIAL TESTING

GDS IS ONE OF THE MOST EXPERIENCED MANUFACTURERS OF DYNAMIC TRIAXIAL SYSTEMS IN THE WORLD, HAVING SUPPLIED MORE THAN 350 SYSTEMS TO COMMERCIAL AND RESEARCH LABORATORIES DURING THE LAST 35 YEARS.

Soil deposits in many geotechnical engineering projects undergo repeated cyclic loadings during their design lifetime, which may be due to environmental factors or human activities. Soil response to dynamic loading is typically more complex than statically loaded cases, requiring engineers to investigate the dynamic behaviour of soils in the laboratory. GDS offers a range of dynamic triaxial testing systems available for use in the laboratory.

**ENTERPRISE LEVEL DYNAMIC TRIAXIAL TESTING SYSTEM (ELDYN)** is the most economical dynamic triaxial system in the GDS range. Based around an axially-stiff load frame with a beam mounted electro-mechanical actuator. The ELDYN has been designed to fulfil demand within the geotechnical laboratory testing industry for a low cost system that is still able to perform to the advanced standards customers expect from GDS.

**ADVANCED DYNAMIC TRIAXIAL TESTING SYSTEM (DYNNTS)** is the superior apparatus in the GDS dynamic triaxial range. Combining a triaxial cell with integral base unit housing an electro-mechanical actuator, the system takes a no-compromise approach to accuracy, stability and features. The DYNNTS also comes with adaptive control as standard, significantly improving apparatus response when conducting dynamic load-controlled tests. This is the system of choice for many advanced commercial and research laboratories around the world.

**RESILIENT MODULUS TESTING SYSTEM (RMTS)** enables the resilient modulus and permanent deformation of unbound base/sub-base pavement materials to be determined. The system uses an ELDYN frame to apply dynamic cyclic loads, with a GDS triaxial cell used to confine the test specimen.

**TRUE TRIAXIAL APPARATUS (GDSTTA)** is an advanced system designed to enable independent control over the three principal stresses applied to a test specimen. This allows a wider range of complex stress path responses to be investigated, and is powered by either advanced electro-mechanical or hydraulic actuators. Overall the GDSTTA offers an extremely sophisticated laboratory tool to research institutions, with control and data acquisition handled by GDSLAB software.

## KEY FEATURES

- Adaptive Control Firmware for increased testing precision.
- Can perform all tests offered by an equivalent static triaxial system.
- Electro-mechanical actuators provide a cost effective hassle free and highly accurate testing system when compared to pneumatic and hydraulic systems.
- User-defined loading waveforms available.
- Automated system control and data acquisition via GDSLAB software.

VIEW ALL PRODUCTS [www.gdsinstruments.com/dynamictriaxial](http://www.gdsinstruments.com/dynamictriaxial)

# DYNAMIC SYSTEMS

## ENTERPRISE LEVEL DYNAMIC TRIAXIAL TESTING SYSTEM



### PRODUCT CODE: ELDYN

TECHNICAL SPECIFICATION:	
Load Range:	5, 10kN
Operating Frequency:	5, 10Hz
Cell Pressure Range:	1MPa (Air)
Sample Size:	38, 39.1, 50, 54, 61.8, 70, 76, 100, 101, 150mm

### KEY FEATURES

- Better performance than pneumatically-actuated load frames in terms of life costs, control, accuracy, stability and safety.
- Electro-mechanical systems are more environmentally friendly as they only draw energy required to run a test, resulting in lower life costs.
- Options to include local strain and pressure measurement transducers, bend elements, and unsaturated soil testing hardware.

## ADVANCED DYNAMIC TRIAXIAL TESTING SYSTEM



### PRODUCT CODE: DYNNTS

TECHNICAL SPECIFICATION:	
Load Range:	10, 40, 60kN
Operating Frequency:	5Hz
Pressure Range:	2, 4MPa
Sample Size:	38, 39.1, 50, 61.8, 70, 100, 101, 150, 300mm

### KEY FEATURES

- Adaptive Control Firmware for increased testing precision & user-defined loading waveforms to mimic specific conditions.
- High accuracy electro-mechanical control allows the user to perform very small strain static tests through to large strain dynamic tests.
- In-built balanced ram (for up to 5Hz systems) keeps cell pressure constant during cyclic loadings.
- Sophisticated feedback control firmware and 5kHz data acquisition enables specimen response at high loading frequency to be captured.

## RESILIENT MODULUS TESTING SYSTEM



### PRODUCT CODE: RMTS

TECHNICAL SPECIFICATION:	
Load Range:	5, 10kN
Operating Frequency:	10Hz
Pressure Range:	1MPa
Sample Size:	70, 71, 100, 150mm

### KEY FEATURES

- Surpasses pneumatic actuators in terms of life costs and overall system response.
- Numerous hardware configurations are available, satisfying system requirements for published test standards.
- To comply with standards, different options can be selected for measuring axial deformations, ranging from localised LVDT's to external linear potentiometers.

## TRUE TRIAXIAL APPARATUS



### PRODUCT CODE: GDSTTA

TECHNICAL SPECIFICATION:	
Load Range:	20kN
Operating Frequency:	5Hz
Cell Pressure Range:	1MPa
Data Acquisition:	16 Bit
Sample Size:	75x75x150mm

### KEY FEATURES

- Two pairs of matched dynamic actuators, plus control over cell pressure, enable independent application of the three principal stresses or strains.
- Electro-mechanical actuators provide a simple-to-use and environmentally friendly solution for accurate dynamic testing up to 5Hz.
- Full specimen preparation equipment for cohesive and granular specimens is provided, including a soil lathe specifically designed for producing cuboidal specimens.



# SHEAR TESTING

GDS LEADS THE WORLD WITH ITS RANGE OF SHEAR TESTING SYSTEMS, OFFERING DIRECT, SIMPLE AND ROTATIONAL SHEAR WITH HIGH AND LOW STRESS VERSIONS, STATIC AND DYNAMIC LOADING, AS WELL AS THE APPLICATION OF BACK PRESSURED OPTIONS.

## SIMPLE SHEAR TESTING:

**STATIC SIMPLE SHEAR SYSTEM (GDSSS)** is an electro-mechanical device designed for statically testing soil specimens in simple shear, however can also be configured to perform direct shear tests via a direct shearbox specimen set. Being a table-top apparatus, the system is suited to everyday commercial work, as well as teaching or research. The system can additionally be used to perform slow-cyclic tests on specimens using the GDSLAB software.

**ELECTRO-MECHANICAL DYNAMIC CYCLIC SIMPLE SHEAR SYSTEM (EMDCSS)** is a no-compromise device created for highly-accurate static and dynamic simple shear testing. With lateral specimen confinement supplied by a low friction ring stack, the system can perform constant height and constant normal stress tests under precise load and displacement control, making it the simple shear apparatus of choice for many advanced commercial and research laboratories around the world.

**CONFINED ELECTRO-MECHANICAL DYNAMIC CYCLIC SIMPLE SHEAR SYSTEM (EMDCSS-CON)** Based on the EMDCSS, the EMDCSS-CON has all the functionality of the EMDCSS with the addition of a confined chamber. The chamber enables full effective stress control of test specimen and simple shear to be performed with controlled saturated or unsaturated conditions, making it an excellent choice for simple shear research applications.

**VARIABLE DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR SYSTEM (VDDCSS)**, based around the EMDCSS design, enables test specimens to be deformed in simple shear in multiple directions and is therefore a full multi-directional simple shear apparatus. This is achieved by installing a secondary shear actuator that acts at 90 degrees to the primary shear actuator. Initially designed for 3D testing of offshore wind farm foundations, the system can conduct the same simple shear tests as the EMDCSS, along with more complex loadings where the horizontal stress direction can be rotated as a test progresses.

**CONFINED VARIABLE DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR SYSTEM (VDDCSS-CON)** is similar in principle to the VDDCSS, but with the addition of a chamber around the specimen such that cell and back pressures can be applied.

## DIRECT SHEAR TESTING:

**BACK PRESSURE SHEARBOX (GDSBPS)** is an advanced system that has the unique feature of being able to perform direct shear tests while precisely controlling the back pressure to model realistic slope failures. The GDSBPS range includes a saturated version (providing control of back/pore water pressure) and an unsaturated version (providing control of back/pore water and pore air pressure), with normal stress applied by electro-mechanical actuator. Given this system's flexibility, it remains popular with research institutions investigating landslide hazards.

**DYNAMIC BACK PRESSURED SHEARBOX (DYNBPS)** includes the same features as the GDSBPS, however comes with normal and shear actuators capable of cyclic loadings up to a frequency of 5Hz. This addition makes the system useful for investigating slope stability in seismically-active areas as well as the ability to investigate high velocity slips.

**LARGE AUTOMATED DIRECT SHEAR SYSTEM (GDSLADS)** is an electro-mechanical direct shear testing system designed for larger specimens up to 305mm square or circular. With load capacities reaching 100kN, the system is suited to testing samples with large particle sizes, such as aggregates with different specimen sets available to enable testing of rock specimens and geo-membranes as well.

## ROTATIONAL SHEAR TESTING:

**INTERFACE SHEAR TESTER (GDSIST)** is an electro-mechanical device designed for testing the interface strength between two differing materials. The system includes a vertical load actuator, a base platen that can infinitely rotate, and a combined load cell to measure vertical load and rotational torque.

**RING SHEAR APPARATUS (GDSRSA)** is a modern, compact, benchtop ring shear system, that allows fully automated testing. The GDSRSA allows torsional ring shear tests, under drained conditions by the rotational shearing action applied continuously via an electromechanical stepper motor until a constant residual shear stress is achieved.

# SIMPLE SHEAR SYSTEMS

### SHEARBASE SYSTEM



#### PRODUCT CODE: GDSSS

TECHNICAL SPECIFICATION:	
Load Range:	5kN (both axis)
Max Speed:	0.25mm/s
Sample Size Simple Shear:	50, 63.5, 66, 70, 100mm
Sample Size Direct Shear:	60, 100mm Square

#### KEY FEATURES

- Footprint of just H x 660mm, L x 660mm, D x 220mm.
- Includes integrated power supply, with mains electricity, no hanging weights are required to run the system.
- Options for Simple & Direct shear sample sets.
- Passive / Active height control, means no intervention is required between stages.
- Constant Normal Stiffness testing as standard.

### ELECTRO-MECHANICAL DYNAMIC CYCLIC SIMPLE SHEAR



#### PRODUCT CODE: EMDCSS

TECHNICAL SPECIFICATION:	
Load Range:	5kN (both axis) 10kN (both axis)
Operating Frequency:	0 (static) to 5Hz
Sample Size:	50, 63.5, 66, 70, 100, 102, 150mm

#### KEY FEATURES

- Electro-mechanical actuators for greater accuracy
- Passive / Active height control, means no intervention is required between stages.
- Little or no effects of vertical compliance due to the extremely stiff system design.
- Adaptive Control Firmware for increased testing precision and Constant Normal Stiffness testing included as standard.

### CONFINED ELECTRO-MECHANICAL DYNAMIC CYCLIC SIMPLE SHEAR



#### PRODUCT CODE: EMDCSS-CON

TECHNICAL SPECIFICATION:	
Load Range:	5kN (both axis)
Operating Frequency:	0 (static) to 5Hz
Sample Size:	50, 66, 70, 100mm

#### KEY FEATURES

- Electro-mechanical actuators for greater accuracy.
- Specimens can be laterally confined using low friction retaining rings or by radial stress, ensuring a constant volume is maintained.
- Pore pressures can be accurately controlled.
- Adaptive Control Firmware for increased testing precision and Constant Normal Stiffness testing included as standard.

### VARIABLE DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR



#### PRODUCT CODE: VDDCSS

TECHNICAL SPECIFICATION:	
Load Range:	5kN Axial Axis, 2kN Shear Axis
Operating Frequency:	0 (static) to 1Hz
Sample Size:	50/70mm (D), 20 to 30mm (H)

#### KEY FEATURES

- Waveform Reference Streaming allows for streaming of long form custom waveforms, in place of normal repeating cyclic or custom waveforms.
- Constant Normal Stiffness testing as standard.
- Shear stress direction can be varied during a dynamic test stage.
- Specimens are laterally confined ensuring a constant cross sectional area is maintained.

### CONFINED VARIABLE DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR



#### PRODUCT CODE: VDDCSS-CON

TECHNICAL SPECIFICATION:	
Load Range:	10kN, 5kN on each shear axis
Operating Frequency:	0 (static) to 1Hz
Sample Size:	50, 100mm

#### KEY FEATURES

- Waveform Reference Streaming allows for streaming of long form custom waveforms, in place of normal repeating cyclic or custom waveforms.
- Adaptive Control Firmware for increased testing precision, with Constant Normal Stiffness testing included as standard.
- Horizontal load and displacement control.
- 6 axis loadcell provides highly accurate readings.

# DIRECT & ROTATIONAL SHEAR

## BACK PRESSURED SHEARBOX



### PRODUCT CODE: GDSBPS

TECHNICAL SPECIFICATION:	
Load Range:	25kN Normal & Shear Force
Pressure Range:	2MPa
Sample Size:	60mm (circular), 75 x 75 or 100 x 100mm (Square)

### KEY FEATURES

Internal submersible load cells record normal and shear forces as close to the specimen as possible for greater measurement accuracy.

Unsaturated upgrade modifies the system to allow measurement and control of matric suction.

## DYNAMIC BACK PRESSURED SHEARBOX



### PRODUCT CODE: DYNBPS

TECHNICAL SPECIFICATION:	
Load Range:	25kN Axial 10kN Shear
Operating Frequency:	0 (static) to 5Hz
Sample Size:	50/75mm square, 20mm height

### KEY FEATURES

Designed for long life and highly accurate position control. Suitable for carrying out small strain testing, long term creep and dynamic tests up to 5Hz.

Shear gap between upper and lower shearbox components is manually set while the system is under pressure.

## LARGE AUTOMATED DIRECT SHEAR



### PRODUCT CODE: GDSLADS

TECHNICAL SPECIFICATION:	
Load Range:	100kN Axial, 100kN Shear
Max Speed:	0.1mm/s
Sample Size:	150 x 150, 200 x 200, 300 x 300mm square, 300mm Round

### KEY FEATURES

Only mains electricity required to run the system (no hydraulics or pneumatics), reducing space and additional equipment requirements.

Flexibility to test different shaped specimens, including sets for testing rock cores.

## INTERFACE SHEAR TESTER 5KN/200Nm



### PRODUCT CODE: GDSIST

TECHNICAL SPECIFICATION:	
Load Range:	5kN
Torque Range:	200N
Pressure Range:	1MPa
Sample Size:	70, 60, 63.5, 67 x 22mm
Speed Range:	0.01° to 720°/min

### KEY FEATURES

Infinitely rotating base platen to allow application of very large rotational deformations.

Low range combined load cell for accurate measurement of applied vertical load and torque.

## RING SHEAR APPARATUS 5KN/200Nm



### PRODUCT CODE: GDSRSA

TECHNICAL SPECIFICATION:	
Load Range:	5kN
Torque Range:	200N
Sample Size:	100mm OD x 70mm ID
Speed Range:	0.01° to 720°/min

### KEY FEATURES

The benchtop system has a small footprint (51cm x 32cm), and low overall weight (30kg) due to not requiring any hanging weights for application of forces.

All data acquisition and control of load/torque and displacement/rotation is taken care of in the one machine. No requirement for additional transducers or the manual application of hanging weights.

# UNSATURATED SOIL TESTING

GDS PROVIDES A NUMBER OF SOLUTIONS FOR THE TESTING OF UNSATURATED SOIL. EACH IS BASED AROUND THE REQUIREMENT TO EITHER DEFINE, OR EXPLORE AREAS AROUND THE STRESS DEPENDENT SOIL WATER CHARACTERISTIC CURVE (SDSWCC) BY VARYING THE MATRIC SUCTION OF THE SOIL. THE MATRIC SUCTION IS THE PRINCIPAL VARIABLE IN DEFINING THE STATE OF STRESS IN AN UNSATURATED SOIL.

Unsaturated soil response is an important consideration for many geotechnical designs, particularly in arid regions around the world where the water table sits at significant depth below the ground surface. Unsaturated soil response is typically more complex than that of saturated soil, leading to considerable study and testing in the research community. GDS' range includes the ability to perform unsaturated testing in triaxial, consolidation, direct or simple shear, resonant column, hollow cylinder and true triaxial apparatus. All of these apparatus use the axis translation method, which is the direct control of matric suction, using precise control of the pore water and pore air pressures through the use of a high air entry porous disk.

GDS has been supplying unsaturated triaxial testing systems into Universities for more than 20 years. Working alongside HKUST in China (Professor Charles Ng) to develop what we call the HKUST unsat method (method B in our range), and developing our own low range differential pressure transducer and suction probe, enabled GDS to stay at the forefront of unsaturated triaxial testing technology.

The axis translation technique is applied to triaxial testing with the addition of an unsaturated testing pedestal, which has a high air entry disc bonded in to it. This allows

pore pressures to be applied and controlled at the base, along with higher air pressures applied to the top-cap of the sample. The challenge for the triaxial test is in the measurement of sample volume change. At GDS we give customers the choice of 4 methods (methods A, B, C and D) which are all explained in the datasheet which can be found on the GDS website.

All GDS triaxial systems can be upgraded into an unsaturated testing system, along with many systems from other manufacturers. Part of the GDS speciality is upgrading systems from other manufacturers where those manufacturers do not provide these advanced options.

## KEY FEATURES

Axis translation method used to control matric suction.

Various air entry values available for ceramic porous discs.

Options to upgrade consolidation, triaxial, direct shear and small-strain systems.

Unsaturated soil calculations automatically handled by GDSLAB.

VIEW ALL PRODUCTS

[www.gdsinstruments.com/unsaturatedsoil](http://www.gdsinstruments.com/unsaturatedsoil)



# CONSOLIDATION TESTING

GDS MANUFACTURES A REPLACEMENT FOR THE HANGING WEIGHT OEDOMETER FOR ONE-DIMENSIONAL CONSOLIDATION TESTS, AS WELL AS MORE ADVANCED CONSOLIDATION SYSTEMS THAT CAN INCLUDE BACK PRESSURE CONTROL, HIGH CONSOLIDATION FORCES, UNSATURATED TESTING AND BENDER ELEMENTS.

One-dimensional consolidation data is required for most geotechnical engineering projects, providing information about the rate and magnitude of soil settlement or swelling as loading conditions are changed. While the hanging weight oedometer has traditionally been employed in commercial and research soil laboratories to assess the consolidation of soil, options also exist that allow application of back pressure, unsaturated soil response to be investigated, and automated tests through PC control.

**AUTOMATIC OEDOMETER SYSTEM (GDSAOS)** is the modern replacement for the traditional hanging weight oedometer. A self-contained electro-mechanical unit, the GDSAOS can be manually controlled via its Smart Keypad, or fully automated from a PC using the USB interface and GDSLAB. There is no requirement for compressed air or user-placed weights, and when used with GDSLAB can perform an array of tests beyond those for which a hanging weight oedometer is designed. Such attributes and the compact footprint make the GDSAOS an excellent solution for commercial laboratories updating older consolidation hardware, as well as for use during undergraduate teaching classes.

**CONSOLIDATION TESTING SYSTEM (GDSCTS)** is a fully-automated consolidation testing system designed around the Rowe and Barden-type cell. Through use of two pressure/

volume controllers, the system applies vertical normal stress and back pressure to soil specimens, each controlled by GDSLAB. The system can also be upgraded to test unsaturated soils, determine hydraulic conductivity, and measure small-strain stiffness with the inclusion of bender elements. These features make the GDSCTS a useful addition to research laboratories but equally suitable for commercial work.

**CONSTANT RATE OF STRAIN CONSOLIDATION CELL (GDSCRS)** is a load frame-based system designed for completing consolidation tests in shorter periods than hanging weight oedometers, with back pressure application supplied as standard. The system can also be configured for high pressure testing, or for determining consolidation properties of unsaturated soils.

# CONSOLIDATION SYSTEMS

## AUTOMATIC OEDOMETER SYSTEM



PRODUCT CODE: **GDSAOS**

TECHNICAL SPECIFICATION:	
Load Range:	10kN, 50kN (Requires LF50)
Sample Size:	35, 38, 50, 60, 63.5, 70, 71.4, 75, 100, 101.6, 112.8mm

### KEY FEATURES

Completion of primary consolidation detected when using GDSLAB, enabling automatic transition between loading increments for all soil types.

Small device footprint significantly reduces the bench space required in the laboratory, with PC connection via USB.

Provides accurate vertical load application from 1N to 10kN, significantly improving on pneumatic consolidation systems that are typically inaccurate at low loadings.

## CONSOLIDATION TESTING SYSTEM



PRODUCT CODE: **GDSCTS**

TECHNICAL SPECIFICATION:	
Stress Range:	3.5MPa
Pressure Range:	3MPa
Sample Size:	50, 61.8, 63.5, 70, 76.2, 100mm

### KEY FEATURES

Direct control over vertical stress applied to the specimen, with either a flexible or rigid porous disc used to ensure uniform stress or deformation.

System automation via GDSLAB enables a range of test stages to be performed, including saturation, stepped loading, and constant rate of strain.

Options to include radial drainage, bender elements, perform hydraulic conductivity tests and consolidate unsaturated soils.

## CONSTANT RATE OF STRAIN CONSOLIDATION CELL



PRODUCT CODE: **GDSCRS**

TECHNICAL SPECIFICATION:	
Load Range:	10kN 50kN (Requires LF50)
Back Pressure Range:	1, 3, 20MPa
Sample Size:	50, 63.5, 70, 75, 100mm x 22mm

### KEY FEATURES

Constant rate of strain consolidation tests may be performed significantly faster than traditional oedometer tests, with more of the specimen response to load recorded.

Specimen cutting ring is placed directly in the consolidation cell, reducing disturbance during test preparation.

Options for interchangeable submersible load cells enable soils of differing size and stiffness to be accurately tested.

## KEY FEATURES

- Automatic detection of secondary consolidation.
- Fully-automated one-dimensional consolidation testing.
- No requirement for heavy weights or compressed air in the laboratory.
- Back pressure application available.
- Temperature control.
- Option to include, hydraulic conductivity determination and unsaturated soil testing.

VIEW ALL PRODUCTS ▶ [www.gdsinstruments.com/consolidation](http://www.gdsinstruments.com/consolidation)



CONSTRUCTION

# TEMPERATURE CONTROL TESTING

GDS OFFERS A RANGE OF TEMPERATURE CONTROL SYSTEMS TO ACCURATELY CONTROL THE TEMPERATURE OF SOIL AND ROCK SPECIMENS, FROM FROZEN CONDITIONS TO HEATED STATES.

GDS has developed temperature control solutions for a range of their triaxial and consolidation systems, allowing the effect temperature change may have on soil and rock to be observed during triaxial consolidation and shearing. With options available for testing unsaturated soils, determining small-strain parameters, and dynamically shearing the test specimens, the addition of temperature control is fast becoming an attractive tool for many research laboratories. An overview of the available temperature-controlled systems can be seen below.

**ENVIRONMENTAL TRIAXIAL AUTOMATED SYSTEM (ETAS)** is a temperature-controlled load frame-based triaxial testing system. Based on the GDSTAS, customers can specify the load frame, pressure/volume controllers and triaxial cell capacity requirements, as well as the range of heating and/or cooling needed. Heating is provided via thermal pads attached to the outside of the triaxial cell, while cooling is supplied through a coiled tube section that connects to an external cooling unit.

heating is provided via thermal pads attached to the outside of the triaxial cell, while cooling is supplied through a heat exchange that connects to an external cooling unit.

**GAS HYDRATE TESTING SYSTEMS** have been developed which can be added to the ETAS and the GDS Resonant Column System. All gas hydrate systems allow for gaseous back pressure such as methane, carbon dioxide or nitrogen to be controlled at high pressure. This, combined with temperatures down to -30°C, provides the necessary environment to grow and test gas hydrates in the laboratory. The systems only require the addition of a system to provide high pressure methane or CO<sub>2</sub> to allow gas hydrate testing to be performed.

**ENVIRONMENTAL TRIAXIAL TESTING SYSTEM (ETTS)** is a temperature-controlled stress path triaxial testing system. Based on a hydraulically-actuated triaxial cell, the ETTS can be configured to customer requirements for load and pressure, as well as their heating and cooling needs. As with the ETAS,

## KEY FEATURES

Heating & Cooling Ranges: -10°C to +60°C, -20°C to +85°C, -30°C to +100°C.

Heating Only Ranges: to +60°C, to +100°C.

Can be adapted for gaseous back pressure fluids such as air, carbon dioxide, nitrogen or methane.

High pressure testing options up to 64MPa confining pressure.

Can be used as standard low pressure ambient temperature triaxial systems.

Optional local deformation measurement, acoustic emission or acoustic velocity transducers.

**VIEW ALL PRODUCTS** [www.gdsinstruments.com/environmentaltriaxial](http://www.gdsinstruments.com/environmentaltriaxial)

# TEMPERATURE CONTROL SYSTEMS

## TRIAXIAL AUTOMATED SYSTEM



### PRODUCT CODE: ETAS

#### TECHNICAL SPECIFICATION (CELLS)

KEY: BR: Balanced Ram, HO: Heating Only, H&C: Heating & Cooling.

4MPa/100kN/100mm/No BR/HO
4MPa/100kN/76mm/No BR/H&C
4MPa/100kN/150mm/No BR/HO
20MPa/100, 250kN/100mm/No BR/H&C
20MPa/100, 250kN/100mm/No BR/HO
64MPa/500kN/76mm/BR/H&C
64MPa/250kN/100mm/BR/HO

### KEY FEATURES

Specimen cooling is provided via a cell mounted heat exchange. This connects to a cooling unit, which can be controlled within the GDSLAB software.

For heat only systems, specimen heating is provided via thermal pads attached to the outside triaxial cell wall, with an additional enclosure used to retain applied heat. The system also includes up to four temperature sensors.

Can be adapted to enable application of gaseous back pressures, with air, carbon dioxide, nitrogen, and methane all compatible.

## TRIAXIAL TESTING SYSTEM



### PRODUCT CODE: ETTS

#### TECHNICAL SPECIFICATION:

Load Range:	100kN
Pressure Range:	10MPa
Sample Size:	38, 50 x 55mm max diameter

### KEY FEATURES

Specimen cooling and heating are provided using an in-cell heat exchanger.

Low to high pressure range configurations can be specified depending on test and research requirements.

Options to include local strain measurement, bender elements and built-in table with lifting frame.

## CONSTANT RATE OF STRAIN



### PRODUCT CODE: GDSCRS

#### TECHNICAL SPECIFICATION:

Load Range:	1, 2, 4, 5, 8, 10, 20, 25, 50, 100kN
Back Pressure Range:	3, 20MPa
Sample Size:	20MPa: 50mm Heating only or Heating / Cooling 3MPa: 100mm Heating only or Heating / Cooling

### KEY FEATURES

This load frame actuated cell can be retrofitted into a number of different sized load frames.

Available in most cells as heating only, or heating and cooling combined.

Constant rate of strain consolidation tests may be performed significantly faster than traditional oedometer tests, with more of the specimen response recorded.

Sealed cell allows for back pressure to be accurately controlled.

## GAS HYDRATE SYSTEM



### PRODUCT CODE: GDSGH

#### TECHNICAL SPECIFICATION:

Load Range:	50, 64, 100, 256kN, VIS100, 250, 400, 500kN, HLF100, 250kN or 1MN
Pressure Range:	20MPa
Sample Size:	50, 70, 100mm

### KEY FEATURES

Gas hydrates require high pressure and low temperature, from this respect this system is a standard GDS high load temperature controlled system.

Additional ports are available such that pore fluids such that methane can be introduced and controlled, as well as argon for flushing.

Computer controlled gaseous pressure controller used to control the relevant pore gases.

Available as a resonant column Gas Hydrate system.



# RESONANT COLUMN TESTING

STOKOE AND HARDIN TYPE RESONANT COLUMN SYSTEMS ARE AVAILABLE FROM GDS, ENABLING THE SMALL-STRAIN STIFFNESS AND DAMPING RESPONSE OF SOIL AND ROCK TO BE ACCURATELY DETERMINED.

### RESONANT COLUMN APPARATUS



**PRODUCT CODE: GDSRCA**

TECHNICAL SPECIFICATION:	
Pressure Range:	1, 2MPa
Operating Frequency:	0 to 300Hz
Sample Size:	38, 39.1, 50, 66, 70, 100mm

### KEY FEATURES

Current-driven resonant loading via a trans-conductance power amplifier to account for magnet/coil impedance variation with loading frequency.

Switches to open circuit when performing damping ratio tests, preventing back EMF generation and enabling fully free specimen vibration to take place.

Options to include bender elements, temperature control, hardware for testing unsaturated soils, and torsional shear loading.

### HARDIN OSCILLATOR



**PRODUCT CODE: H-RCA**

TECHNICAL SPECIFICATION:	
Load Range:	5kN
Pressure Range:	1MPa
Operating Frequency:	0-300Hz
Sample Size:	50, 70, 100mm

### KEY FEATURES

Reaction mass integrated into the drive system, placing this as close to the torsional force generation as possible to eliminate load uncertainties.

Hybrid-style triaxial cell allows the cell wall to be lifted clear of the specimen while the top-cap is supported in place, enabling simple and accurate specimen installation.

Standalone GDSRCA software used to perform resonant and damping tests, while GDSLAB controls the application of vertical load and confining pressure.

## KEY FEATURES

Determination of shear modulus degradation and damping ratio at small strains.

Anisotropic stress states may be applied in the Hardin type system.

Upgrade available to conduct torsional shear tests.

Options to include bender elements, unsaturated testing hardware, and temperature control.

**VIEW ALL PRODUCTS**

[www.gdsinstruments.com/resonantcolumn](http://www.gdsinstruments.com/resonantcolumn)

# HOLLOW CYLINDER TESTING

GDS SPECIALISES IN DESIGNING AND MANUFACTURING ADVANCED TESTING SYSTEMS FOR RESEARCH WORK, WHICH INCLUDES A NUMBER OF HOLLOW CYLINDER APPARATUS CONFIGURATIONS.

Hollow cylinder apparatuses have been used by top research institutions for numerous years, allowing complex stress paths to be applied to soil specimens by controlling the magnitudes and directions of the three principal stresses applied to a test element. With static and dynamic options available, as well as the ability to include localised small-strain deformation measurement, the GDS hollow cylinder is useful for many testing applications, including verification of constitutive models and investigating the dynamic response of soil during seismic events.

### HOLLOW CYLINDER APPARATUS



**PRODUCT CODE: GDSHCA**

TECHNICAL SPECIFICATION:	
Load Range:	10, 20kN
Pressure Range:	1MPa
Operating Frequency:	5Hz
Sample Size:	100/60/200 mm or 200/160/400 mm (OD, ID, height)
Torque Range:	100, 200, 400Nm

### KEY FEATURES

Combined internal submersible load cell measures vertical load and torque while eliminating error from confining pressure variation and ram friction.

Flexibility in system loading capacity, specimen size, and applied pressures ensures the system is configured to suit testing and budgetary requirements of the user.

Options available to include local displacement transducers for small strain measurement, and dynamic cell pressure/volume controllers.

Can be used for triaxial tests.

## KEY FEATURES

Adaptive Control Firmware for increased testing precision.

High axial and torsional stiffness.

Built in access ports and cell top lift as standard.

Control and parameter calculations automatically handled by GDSLAB.

Dynamic cyclic cell and back pressure options available.

**VIEW ALL PRODUCTS**

[www.gdsinstruments.com/hollowcylinder](http://www.gdsinstruments.com/hollowcylinder)

# ROCK MECHANICS

GDS HAS MANUFACTURED HIGH PRESSURE AUTOMATED TRIAXIAL TESTING SYSTEMS FOR ROCK FOR OVER 25 YEARS, WITH SYSTEMS INSTALLED AT LEADING RESEARCH AND COMMERCIAL INSTITUTES AROUND THE WORLD.

To assess the deformation and failure characteristics of rocks in the laboratory, test equipment must be stiff to avoid tremendous backlash and spring effects at failure, as well as robustly designed and manufactured to ensure consistent results year on year. The GDS rock mechanics range is built to meet these requirements, providing high load and pressure test systems with options to include advanced transducers, such as acoustic velocity and acoustic emission.

## STATIC TRIAXIAL ROCK TESTING SYSTEM



### PRODUCT CODE: ST-RTS

TECHNICAL SPECIFICATION:	
Load Range:	100, 250, 400kN, 1MN
Pressure Range:	4, 20, 64MPa
Sample Size:	50, 54, 70, 100, 150mm

### KEY FEATURES

Axial loads generated by a GDS 64MPa pressure volume controller, or electro-mechanical load frame.

Stiff frame construction that exceeds ISRM recommendations, reducing equipment compliance and increasing measurement accuracy.

Clean and quiet system operation, designed for long term tests. Very low power consumption and no system cooling requirements.

## TRIAxIAL (ACTIVE CELL) ROCK TESTING SYSTEM



### PRODUCT CODE: AT-RTS

TECHNICAL SPECIFICATION:	
Load Range:	2MN
Pressure Range:	64MPa
Sample Size:	150 diameter x 300mm tall

### KEY FEATURES

Axial loads generated by a GDS 64MPa pressure volume controller, with stress directly applied to the test specimen.

Options to include Acoustic Emission and Acoustic Velocity transducer measurement systems.

Upgrades available to provide local strain measurement, along with temperature control systems for specimen heating and cooling.

## ACOUSTIC EMISSION



### PRODUCT CODE: GDSAE

TECHNICAL SPECIFICATION:	
Pressure Range:	100MPa in non-conducting fluid.
Sample Size:	Fits all sample sizes
Data Acquisition:	10, 50MHz

### KEY FEATURES

High speed data acquisition systems (10MHz – 50MHz) available up to 16-bit for high resolution measurements.

Transducer systems range from simple fracture counters through to complete systems that locate the fracture origin within the specimen.

Option to include velocity tomographic surveys to map acoustic velocity variations within a rock specimen.

# ROCK SYSTEMS

## ACOUSTIC VELOCITY



### PRODUCT CODE: GDSAV

TECHNICAL SPECIFICATION:	
Axial Load:	250kN
Pressure Range:	64MPa
Sample Size:	25, 38, 50mm

### KEY FEATURES

Standard package includes hardware to measure P-wave velocity, along with S-wave velocities using two polarities.

High speed data acquisition system supplied to produce high resolution wave propagation data.

Transducer hardware designed to fit most GDS high pressure triaxial and Hoek cells.

## INSTRUMENTED HOEK CELL



### PRODUCT CODE: GDSIHC

TECHNICAL SPECIFICATION:	
Load Range:	500kN, 1000kN
Pressure Range:	64MPa
Sample Size:	500kN: 38mm, 1000kN: 50.8mm

### KEY FEATURES

Option to include up to 12 channels of Acoustic Emission transducers for monitoring micro-fractures.

Option to include vertically and horizontally propagating Acoustic Velocity transducers for P- and S-wave measurements.

Can be supplied as a standalone cell, or with load and specimen confinement devices.

## LARGE AUTOMATED DIRECT SHEAR SYSTEM (305mm)



### PRODUCT CODE: GDSLADS

TECHNICAL SPECIFICATION:	
Load Range:	100kN Axial, 100kN Shear
Max Speed:	0.01mm/s
Sample Size:	150 x 150, 200 x 200, 300 x 300mm square, 300mm Round

### KEY FEATURES

Only mains electricity required to run the system (no hydraulics or pneumatics), reducing space required and additional equipment requirements.

Flexibility to test different shaped specimens, including sets for testing rock cores.

Stiff shearbox construction reduces system compliance and increases accuracy of strain measurements.

## BACK PRESSURE SHEARBOX (HIGH PRESSURE)



### PRODUCT CODE: HPBPS

TECHNICAL SPECIFICATION:	
Load Range:	100kN Axial, 75kN Shear
Pressure Range:	10MPa
Sample Size:	50 or 100mm (Cylindrical) x 50mm high

### KEY FEATURES

Accurate application of loading conditions through electro-mechanical control of normal and shear forces.

Precise displacement measurements enable long-term creep tests to be performed.

Back pressure applied using GDS Advanced Pressure Volume Controller.



PRESSURE/VOLUME CONTROLLERS



ENTERPRISE LEVEL PRESSURE VOLUME CONTROLLER  
ELDPC

General purpose water pressure source and volume change gauge. 1MPa pressure rating and 200cm<sup>3</sup> volumetric capacity. Typically used in commercial testing, teaching applications and lower cost systems.



STANDARD PRESSURE VOLUME CONTROLLER  
STDDPC

Our mid-range water pressure source and volume change gauge. 1, 2, 3 & 4MPa pressure ratings available all with 200cm<sup>3</sup> volumetric capacity. Can also use DigiRFM interface. Typically used in advanced commercial testing and research systems.



ADVANCED PRESSURE VOLUME CONTROLLER  
ADVDPV

Advanced water pressure source and volume change gauge. Up to 4MPa pressure ratings available in 200cm<sup>3</sup> model or up to 2MPa available with 1000cm<sup>3</sup> volumetric capacity. Compatible with DigiRFM interface. Typically used in research systems. (1000cc shown).



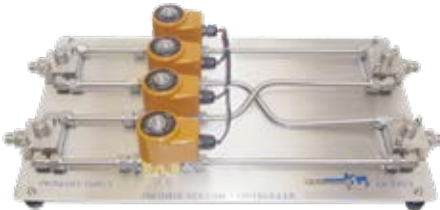
HIGH PRESSURE VOLUME CONTROLLER  
HPDPC

Advanced water pressure source and volume change gauge. Capacities from 8MPa up to 100MPa with 200cm<sup>3</sup> volumetric capacity. Compatible with DigiRFM interface. Typically used in offshore or rock mechanics applications.



HIGH PRESSURE/VOLUME CONTROLLER (CORROSIVE FLUID)  
HPDPC-H

Similar to the HPDPC but with upgraded materials for all wetted components. Typically used when unknown contaminants may be present or when actions of corrosive materials are being investigated.



INFINITE VOLUME CONTROLLER  
GDSIVC

Compatible with all GDS controllers up to 4MPa this automatic switching unit is used to provide seamless pressure or volumetric flow between an external reservoir and test station. Two similar controllers are used with this system. High pressure 64MPa version also available.



PNEUMATIC PRESSURE CONTROLLER (1 OR 2 MPa)  
GDSPPC

An economical computer controlled air pressure regulator, available in 1MPa or 2MPa ranges and in single or dual output. This can be used from a compressor fed airline or compressed gas cylinder. Typically used in unsaturated testing and in low cost dynamic applications.



HIGH PRESSURE PNEUMATIC CONTROLLER (20 MPa)  
DCHGP

This high pressure gaseous controller has a capacity up to 20MPa. This allows gasses to be used in much higher pressure systems than in traditional systems. Typically used where confining fluid viscosity is of importance such as in resonant column testing. Available in single or dual output.



DIGITAL REMOTE FEEDBACK MODULE  
DIGIRFM

The DigiRFM allows a remote transducer to be directly connected to the standard and advanced controller ranges such that the transducer can be used as the primary measurement for control. Typically used to connect a lower range pressure transducer (for increased accuracy or resolution), differential pressure transducer (for low effective stresses) or even loadcell or displacement transducer.

TRANSDUCERS AND LOAD CELLS



BENDER ELEMENT SYSTEM  
GDSBES

Enables measurement of the maximum shear modulus of soil. Can perform S- and P- wave testing with the same elements. Vertical and horizontally propagating elements available.



BENDER ELEMENT CORE HOLDER  
GDSBCH

Facilitates an aligned measurement of S- and P- wave through an unconfined cylindrical soil specimen.



HALL EFFECT LOCAL STRAIN TRANSDUCERS  
GDSHE

Mounted locally on a specimen to measure small strain vertical and radial deformations. Lightweight to minimise specimen disturbance. Working pressures up to 2MPa.



LVDT LOCAL STRAIN TRANSDUCERS  
LVDT

Mounted locally on a specimen to measure small strain vertical and radial deformations. Working pressures of up to 3.5MPa or 100MPa version for use in non-conducting oil.



INTERNAL SUBMERSIBLE LOAD CELL  
GDSISLC

Unique two part submersible load cells, designed for measuring compressive loads ranging from 0.5kN to 100kN. Unaffected by variations in confining pressure.



MID PLANE PORE PRESSURE AND MID PLANE SUCTION PROBES  
GDSM4P

Provides direct measurement of the pore pressure or suction at the specimen mid-height. Available for 1.5 or 3.5MPa.



ULTRA LOW RANGE WET-WET PRESSURE TRANSDUCER  
ULR-WW

Calibrated to directly measure specimen volume change during saturated and/or unsaturated soil testing. Requires use of HKUST internal cell. Range  $\pm$  1kPa.



LINEAR POTENTIOMETER DISPLACEMENT TRANSDUCER  
LPDT

Mounted externally to provide deformation measurements. Body diameter 19mm. Available in various ranges.



EXTERNAL S-BEAM LOAD CELL  
S-BEAM

Mounted externally to provide measurements of force. Available in various ranges.



FORCE ACTUATOR  
GDSFA

General purpose loading system with continuous readout of force and displacement. 10kN, 25kN and 50kN options are available.



PORE PRESSURE TRANSDUCER  
GDSPT

Mounted to provide accurate pressure measurements during testing. Available in various ranges.

# GDSLAB: THE ULTIMATE IN FLEXIBILITY

Our laboratory software package, 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.

START WITH OUR CORE GDSLAB KERNEL...



THEN ADD IN THE MODULES FOR YOUR SPECIFIC TASK:

TRIAXIAL TESTING

OEDOMETER LOGGING

CONSOLIDATION

SHEAR TESTING

HOLLOW CYLINDER

## TRIAXIAL TESTING SOFTWARE MODULES

### DATA ACQUISITION, LOGGING AND RETRIEVAL:

Provided free of charge with every GDSLAB kernel. Provides all data related functions but no test control.

### SATURATION & CONSOLIDATION PROCEDURES:

Cell and back pressure control for saturation, (stepped or ramp), consolidation and B-check tests.

### STANDARD TRIAXIAL TESTING:

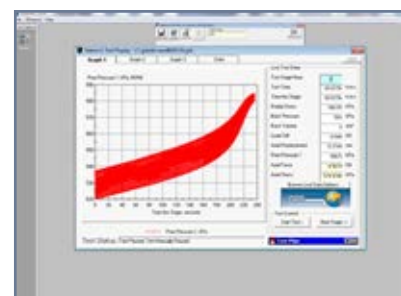
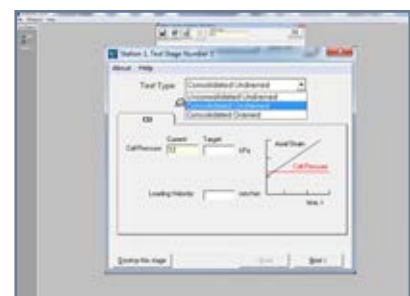
Constant rate of strain control for unconsolidated undrained (UU), consolidated undrained (CU) and consolidated drained (CD) shearing tests.

### STRESS PATH CONTROLLED TESTS:

Independent linear control of p, q or s, t stress space with unlimited number of linked paths.

### ADVANCED LOADING (USER DEFINED TEST SEQUENCES):

Independent user control over the axial (load, stress or strain), radial and back pressure axes with control options of constant value, ramp or quasi-static sinusoidal cyclic applied separately to each axis.



### K-ZERO CONTROLLED CONSOLIDATION/SWELLING:

Maintains zero diameter change (K0 conditions) by two methods, either from a direct reading of the specimen diameter or using specimen volume change calculations.

### TRIAXIAL PERMEABILITY EVALUATION:

Controls either a constant head permeability test, or a constant flow permeability test with controlled hydraulic gradient control.

### UNSATURATED TESTS USING AXIS TRANSLATION - 4D STRESS/STRAIN PATH:

Independent control of the axial axis (load, stress or strain), radial stress, pore water pressure and pore air pressure for complete flexibility of control for unsaturated triaxial tests.

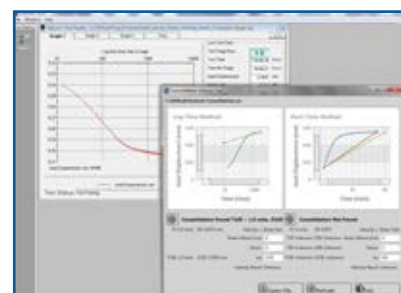
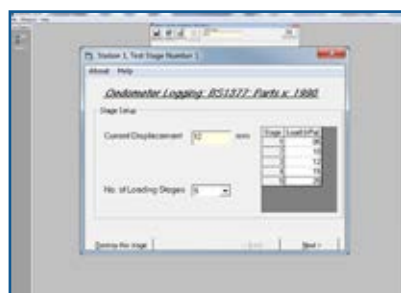
### DYNAMIC TRIAXIAL TESTS:

High speed dynamic cyclic triaxial testing with high speed data acquisition. Test control of dynamic axial load or axial displacement, with static cell and back pressure control. Dynamic control of axial stress and/or radial stress is available dependant on hardware.

## OEDOMETER LOGGING MODULE

### HANGING WEIGHT SYSTEM (OEDOMETER LOGGING):

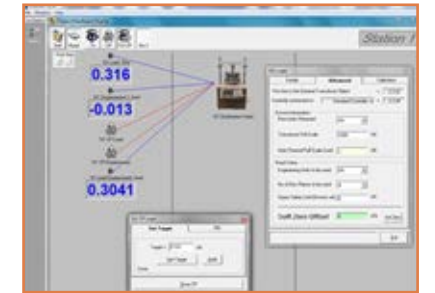
Uses a datalogger and displacement transducer to take settlement readings from hanging weight oedometer frames.



## CONSOLIDATION SOFTWARE MODULE

### STANDARD CONSOLIDATION PROCEDURES:

This test module allows the user to perform; B-check, saturation, constant stress, traditional stepped loading test, constant rate of strain and constant rate of loading tests. Versions of our consolidation cells are available that allow unsaturated tests to be performed using the axis translation technique.



## SHEAR TESTING SOFTWARE MODULES

### DIRECT SHEAR BOX CONTROL:

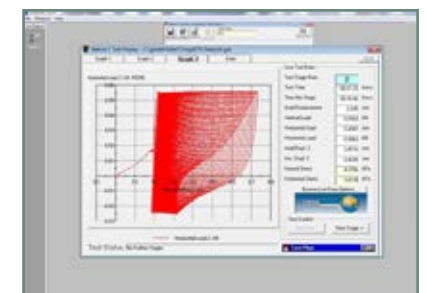
Generally used with direct shear or ring shear devices. Provides acquisition only or control where hardware permits for linear or linear cyclic reversal of a shear box or a ring shear machine. Ideal for upgrading manually logged equipment.

### ADVANCED DIRECT AND DIRECT SIMPLE SHEAR MODULE:

Independent control over the axial axis (load, stress or strain) and shear axis (load, stress or strain) with constant, ramp or quasi-static sinusoidal cyclic control on either axis. Unsaturated tests may be performed using the axis translation technique.

### DYNAMIC SIMPLE SHEAR:

High speed dynamic cyclic simple shear testing with high speed acquisition. Test control of dynamic axial and shear axes under load or displacement. Allows modulus, damping and liquefaction studies to be carried out.



## HOLLOW CYLINDER SOFTWARE MODULES

### HCA GENERALISED STRESS PATH:

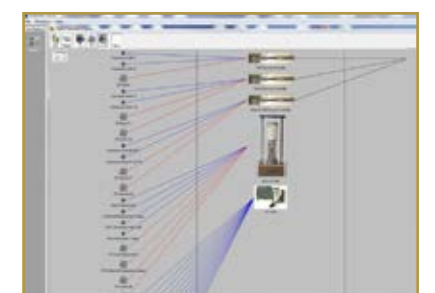
Provides independent linear control of p, q, b and alpha under stress or strain control. This module provides the fundamental HCA stress path control functions that test specifications demand, with unlimited number of linked paths.

### ADVANCED HCA LOADING PROCEDURES:

Allows quasi-static independent control of the five axes; Axial (load, stress, strain, deformation), Rotational (torque, rotation), Outer Cell pressure (kPa), Inner Cell pressure (kPa) and Back pressure (kPa) using either constant, ramp or slow speed sinusoidal control.

### DYNAMIC HCA LOADING:

High speed dynamic cyclic testing with high speed data acquisition. Test control of dynamic axial load or axial displacement, and dynamic control of torque or rotation. Optional dynamic control of inner and outer cell pressures depending on system specification.



GDS PRODUCT SPECIFIC SOFTWARE

BENDER ELEMENT SOFTWARE

RESONANT COLUMN SOFTWARE MODULE

RESILIENT MODULUS SOFTWARE MODULE

GDSLAB REPORTS



# LABORATORY SYSTEMS FOR SOIL & ROCK

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