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LABORATORY SYSTEMS FOR SOIL AND ROCK

GDS INSTRUMENTS
PRODUCT CATALOGUE 2019

WELCOME TO GDS INSTRUMENTS

PRODUCT CATALOGUE

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DEAR READER

GDS is now officially 40 years old! Created in 1979 by Dr Bruce Menzies and Dr Patrick Hooker. I have been lucky enough to work at GDS for more than half of those years, with 14 of them alongside Bruce and Patrick. We continue to develop our technologies and expand our range. New for 2019 includes a range of hydraulic load frames with low platen height, which allows much easier access for large cells. The lower level of platen means that large cells (for samples up to 500mm diameter) can be slid in and out of the frame just 40cm from the floor, so not only easier, but safer too. Combined with the hydraulic cell top lift, overall ease of sample preparation for large systems has been addressed (see page 19).

After 4 years of research and development we have also released our new advanced dynamic control system (ADVDCS version 2). To read all about its advantages over version 1, see facing page. Being able to control digitally means we can access a new world of reliability with direct digital control, whilst we have ensured we still have an analogue option so the new control system is backwards compatible for all analogue systems. Ensuring current GDS customers are secure for the future and can take advantage of new system performance specifications has always been core to GDS' values. I think it might have even been Bruce who first coined the now commonly used phrase 'future-proof'.

And finally, GDS' Advanced pressure controller, which is basically the reason GDS started in 1979 with the first commercial computer controlled stress path system, has been updated to version 4. This new incarnation (see page 28, or the website for more detail) has greater resolution, but most significantly has greater control speeds. For example, initial tests show that the controller can maintain constant pressure with a flow rate more than 5 times faster than the previous version. Quite remarkable.

Karl Snelling, Managing Director

2019 PRODUCT GUIDE | P20
FULL PRODUCT LISTING

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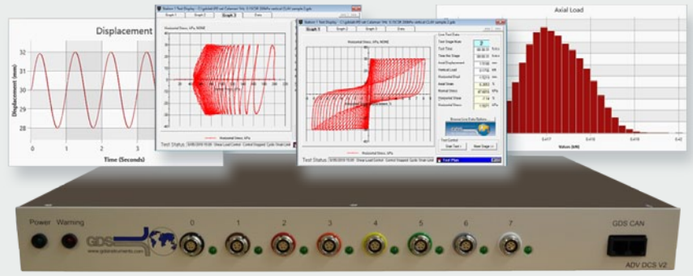
NEW CONTROL SYSTEM FOR DYNAMIC TESTING IN 2019

The ADVDCS V2 is a modern high speed digital control and acquisition system developed specifically for geotechnical testing. The ADVDCS V2 has been fully designed and developed by GDS' in-house research and development team, which includes experts and PhDs from multiple disciplines such as geotechnical engineering, electronics, firmware, software and control theory.

The ADVDCS V2 is based around a modern, high speed, 32 bit processing core and has eight simultaneous sampling 24 bit universal analogue input channels, enabling any transducer in the GDS range to be connected. High speed digital bus technology allows real-time streaming of transducer data making it ideal for high speed data acquisition. The ADVDCS V2 supports full digital control of servo motor and hydraulic actuators allowing accurate, precise and noise free control of actuators and also analogue control to ensure this system is backward compatible for GDS systems already in the field.

Over the last four years GDS has been developing state-of-the-art Adaptive Control technologies that provide high-performance, high-accuracy dynamic control with unparalleled precision. The ADVDCS V2 is the direct result of this research and contains machine learning algorithms that adapt in real-time to dynamic changes in sample compliance. Thereby, delivering excellent control over the full machine performance envelope. In conjunction with the new control box the system drives have been upgraded.



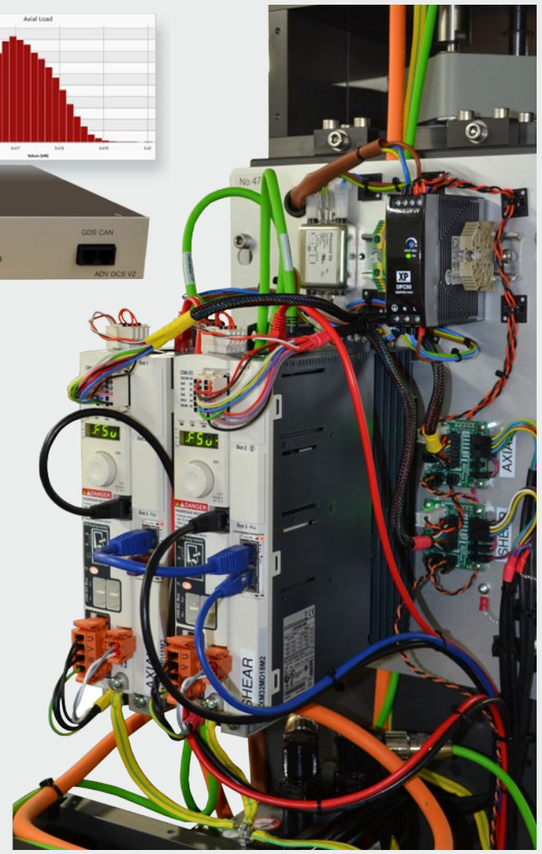
NEW ADVDCS V2 Control box

Inputs
- 8 analogue channels with digitally switchable gain ranges.
- High resolution (24 bit) data acquisition and signal conditioning.
- 5 kHz data acquisition rate.
- Linear, polynomial and custom transducer calibration.
- Up to 32 virtual transducers (e.g. strain, compliance, calculated values).

Control
- 1 kHz 32-bit floating point control loop.
- Adaptive load and stress control.
- Ramp, sinusoidal and custom waveforms.
- CANbus 1 Mbit/s digital interface.
- Real time specimen compliance estimation.

Display and monitoring
- High resolution real time graphs.

Multi-box capabilities
- Up to 4 devices can be connected together for synchronised control and acquisition.



New control system and drives for the Electromechanical Dynamic Cyclic Simple Shear Device (EMDCSS)

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/1MPa) are generally the system of choice for commercial laboratories, with the upper range system (1MN-2MN/32MPa-100MPa) the choice for rock mechanics laboratories. A heating and cooling system can also be added to the GDSTAS to enable temperature control – see the Environmental Triaxial 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 Environmental Triaxial 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

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Example shown, 50kN/2MPa Triaxial Automated System (GDSTAS)

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DYNAMIC TRIAXIAL TESTING

GDS IS ONE OF THE MOST EXPERIENCED MANUFACTURERS OF DYNAMIC TRIAXIAL SYSTEMS IN THE WORLD, HAVING SUPPLIED MORE THAN 250 SYSTEMS TO COMMERCIAL AND RESEARCH LABORATORIES DURING THE LAST 30 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 for 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 lab.

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 (DYNTTS) 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 DYNTTS 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

- High accuracy electro-mechanical or hydraulic actuator control
- 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

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Enterprise Level Dynamic Triaxial Testing System (ELDYN)

Advanced Dynamic Triaxial Testing System (DYNTTS) with optional lifting frame

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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.

The direct shear test, in which a soil or rock specimen is sheared along a pre-defined plane, is one of the most common strength tests conducted in the laboratory. GDS has developed a range of direct shear systems, which covers the standard shearbox seen in many commercial laboratories (GDSSS) up to static and dynamic systems that allow for application of back pressures (GDSBPS). In addition to direct shear, GDS offers a direct simple shear testing systems (EMDCSS), in which a laterally-confined cylindrical soil specimen is deformed statically or dynamically in simple shear. Here options include the ability to shear specimens in multiple directions via a 3D loading system (VDDCSS).

KEY FEATURES

- Back pressure application available
- High accuracy electro-mechanical actuator control
- Static and dynamic loading options for direct shear and simple shear
- High pressure and high load systems for testing rock and/or larger particle sizes
- Ability to control constant normal stiffness via GDSLAB
- Options to include bender elements and test unsaturated soils

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Electromechanical Dynamic Cyclic Simple Shear Device (EMDCSS)

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.

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. 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.

MULTI-DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR SYSTEM (MDDCSS) 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 options to apply normal stress via hanging weights or an 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 by an electromechanical stepper motor until a constant residual shear stress is achieved.

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.

KEY FEATURES

- Fully-automated one-dimensional consolidation testing
- No requirement for heavy weights or compressed air in the lab
- Back pressure application available
- Temperature control
- Options to include bender elements, hydraulic conductivity determination and unsaturated soil testing

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High Pressure 20MPa Constant Rate of Strain cell with temperature control

Automatic Oedometer System (far left) in 10kN Load Frame. Additional set-ups available in the 10kN load frame (Left to right), Permeability, Unconfined Compression Testing, Triaxial and Constant Rate of Strain

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ENVIRONMENTAL TRIAXIAL TESTING

GDS OFFERS A RANGE OF TRIAXIAL 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 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.

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, 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, ETTS 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 -20°C, provides the necessary environment to grow and test gas hydrates in the laboratory. The ETAS and ETTS only require the addition of a system to provide high pressure methane or CO_2 to allow gas hydrate testing to be performed.

KEY FEATURES

- Standard Heating & Cooling Range
  - -10°C to +65°C
  - -20°C to +85°C
  - -30°C to +100°C
- Standard Heating Only Range
  - to +65°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 100MPa confining pressure
- Can be used as standard low pressure ambient temperature triaxial systems
- Option to include local deformation measurement, acoustic emission or acoustic velocity transducers

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Environmental Triaxial Automated System (ETAS). Model shown, 100kN, -20°C to 85°C, 2MPa

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.

The small-strain stiffness and damping behaviour of soil and rock provides an integral component for dynamic response analyses conducted as part of geotechnical design and assessment. The resonant column apparatus is employed by many commercial and research laboratories around the world to measure the variation in these parameters as strain levels increase. The two most well-known and respected configurations of this device are available from GDS (Stokoe and Hardin), with options offered for testing unsaturated soils, temperature control and gas hydrate testing.

RESONANT COLUMN APPARATUS (GDSRCA) is a Stokoe-type device used to determine values of shear modulus and damping ratio across the small to medium shear strain range (< 1 %). The system may also be used in flexure, and is controlled via test-specific GDSRCA software. Options are available to include an environmental temperature control chamber (-20°C up to +40°C), a vertical loading actuator, a high pressure confinement cell, and an upgrade to enable torsional shear tests to be conducted at dynamic frequencies (<10Hz).

HARDIN TYPE RESONANT COLUMN APPARATUS (H-RCA) is used to determine values of shear modulus and damping ratio while an anisotropic stress state is maintained. This is achieved by a slender, thin-walled loading column that passes through the oscillating drive system to the specimen top-cap. The apparatus can either be mounted as a stand-alone system with integral vertical force actuator, or within a triaxial-style cell for use with a load frame.

KEY FEATURES

- Determination of shear modulus degradation and damping ratio at small strains
- Isotropic or anisotropic stress states may be applied to specimens
- 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

Resonant Column Apparatus, Stokoe-Type (GDSRCA)

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.

SMALL-STRAIN HOLLOW CYLINDER APPARATUS (HCA) enables vertical load deformation as well as rotational torque to be applied to a hollow cylindrical soil specimen, with the three principal stress magnitudes and directions controlled via the GDSLAB software. The HCA system is designed around a central core of components, providing high levels of axial and torsional stiffness coupled with minimum backlash and friction. The dynamic option can also conduct loading stages at frequencies up to 5Hz. Options exist for testing unsaturated specimens and large scale specimens up to 200mm in diameter.

KEY FEATURES

- High axial and torsional stiffness
- Built in access ports and cell top lift as standard
- Control and parameter calculations automatically handled by GDSLAB
- Combined submersible vertical and torque load cell included
- Dynamic cyclic cell and back pressure options available

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Small Strain Hollow Cylinder Apparatus (GDSHCA) with inner and outer cyclic cell pressure control

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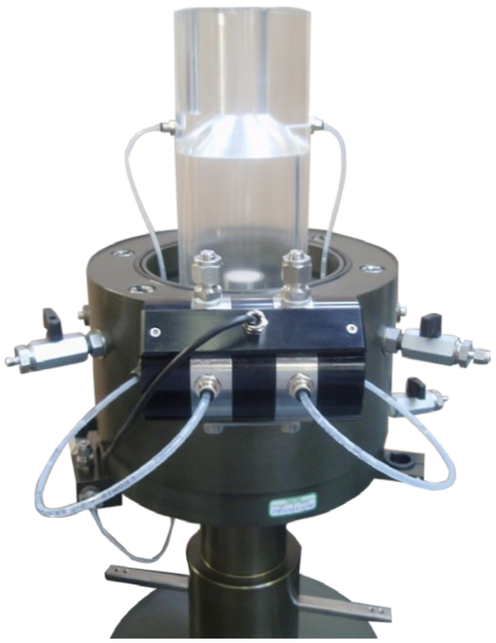
UNSATURATED SOIL TESTING

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. The 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.



Triaxial Testing System (GDSTTS) with HKUST inner cell upgrade

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
- Multiple configurations offered for volume change measurement in triaxial systems
- Unsaturated soil calculations automatically handled by GDSLAB

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www.gdsinstruments.com/unsaturatedsoil

UNSATURATED TRIAXIAL TESTING GDS has been supplying unsaturated triaxial testing systems into Universities for more than 20 years. Working alongside HKUST in China (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.

UNSATURATED SHEAR TESTING. Compared to the triaxial test, the direct shear test is simpler to perform and requires shorter test durations due to the smaller drainage paths. A high air-entry ceramic disk is installed in the lower part of the direct shear box, air pressure is controlled using a GDS software controlled air pressure regulator, and pore water pressure is controlled using a GDS pressure/volume controller. Sample volume is measured directly from the shear travel and sample height (due to the fact that direct shear samples are constrained, sample volume measurement is relatively simple).

UNSATURATED CONSOLIDATION TESTING whether using the Rowe and Barden type system or a GDSCRS type system, the sample is contained within a circular, fixed diameter ring equipped with a high air-entry ceramic disc at its base. Vertical stress is applied through a loading frame (GDSCRS) or using the upper chamber pressure (Rowe and Barden), and axial force is measured with a load cell or directly from the pressure in the upper chamber. Because the radial deformation is zero for the K0 condition, the total volume change of the specimen is measured from the vertical displacement of the soil specimen. Using either of these apparatus, the volume change can be accurately measured and the stress dependent soil water characteristics curve (SDSWCC) can be determined.

UNSATURATED RESONANT COLUMN TESTING. The resonant column's ability to measure soil stiffness at small strains with enough strain variability to measure the upper portion of the modulus degradation curve within soils, makes it an extremely attractive apparatus for testing unsaturated soils. A high air entry porous stone is fitted into the base pedestal, and pore air and water pressures are applied in the same way as a triaxial test. Note: A GDS resonant column apparatus can be upgraded to become an unsaturated system at any time.

UNSATURATED HOLLOW CYLINDER TESTING. All GDS hollow cylinder apparatus can be upgraded to perform unsaturated hollow cylinder testing. A high air entry porous stone is fitted into the base pedestal, which consists of a number of circular disks. The pore air and water pressures are applied in the same way as a triaxial test.

UNSATURATED TRUE TRIAXIAL TESTING. The GDS true triaxial apparatus can be upgraded to perform unsaturated tests. High air entry porous stones are fitted into the base actuator plate, and pore air and water pressures are applied in the same way they are in a triaxial test.

ROCK MECHANICS

GDS HAS MANUFACTURED HIGH PRESSURE AUTOMATED TRIAXIAL TESTING SYSTEMS FOR ROCK FOR OVER 20 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 sufficiently designed and manufactured to ensure consistent results year on year. The GDS rock mechanics range is therefore built to meets 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 (ST-RTS) is a triaxial system which enables load application up to 2MN using a passive triaxial cell and stiff load frame, or alternatively a 2MN active triaxial cell which applies load via its own hydraulic piston. Triaxial confining pressures of up to 100MPa are common when using this system.

ACTIVE CELL (AT-RTS). The high pressure active triaxial cell is capable of reaching axial loads up to 2MN. The system comes with its own lifting frame, with a in-built winch to remove the specimen and top section of the cell.

DYNAMIC HYDRAULIC LOAD FRAMES (HLF) are cyclic triaxial system designed to apply loads up to 1500kN, at loading frequencies of up to 5Hz, 10Hz, or 20Hz. Triaxial confining pressures of up to 70MPa may be reached with this system, due to use of a dynamic pressure intensifier to ensure cell pressures are accurately and consistently controlled.

ACOUSTIC EMISSION (AE) AND ACOUSTIC VELOCITY (AV) transducers may be included with the GDS Instrumented Hoek Cell, or GDS high pressure triaxial cells.

LARGE AUTOMATED DIRECT SHEAR SYSTEM (GDSLADS) is an electro-mechanical direct shear testing system designed for specimens up to 305mm square or circular. GDS also offers a rock mechanics specimen set to enable solid rock testing within the device.

HIGH PRESSURE BACK PRESSURE SHEARBOX (HPBPS) is a high pressure version of the GDS back pressured shearbox, which has the unique feature of being able to perform direct shear tests with precise back pressure control for realistic modelling of slope failures. The system can load specimens to 100kN in the normal and shear directions, with a back pressure of up to 10MPa being maintained during testing.

KEY FEATURES

- Systems are configured to the customers' test specifications and budgets
- Automated system control and data acquisition via GDSLAB software
- Stiff load frames to avoid backlash and spring effects
- Triaxial and Hoek cells available for specimen confinement
- Options to install Acoustic Velocity and Acoustic Emission transducers
- Load frames with electro-mechanical or hydraulic actuation available

VIEW ALL PRODUCTS
www.gdsinstruments.com/rockmechanics

Large Automated Direct Shear System (GDSLADS)

Low level 250kN load frame with automated cell top lift

PRODUCT GUIDE
GDS INSTRUMENTS

FULL PRODUCT LISTING

STATIC TRIAXIAL TESTING

TRIAXIAL AUTOMATED SYSTEM

PRODUCT CODE: GDSTAS

The Triaxial Automated System is a load frame-based static triaxial testing system. The system is configured by choosing from a range of load frames, triaxial cells, pressure controllers and software to suit the user's testing requirements.

KEY 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

The Triaxial Testing System is fully automated and principally designed for stress path testing. Based on the Bishop and Wesley stress path triaxial cell, axial stresses can be applied directly to the test specimen.

KEY FEATURES

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.

The Bishop and Wesley cell is designed specifically for stress path testing. Direct axial stress application means greater accuracy for stress control.

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

The Virtual Infinite Stiffness loading systems, exclusive to GDS, are designed to be stiffer than classical load frames. This allows accurate testing of stiff specimens with less equipment compliance present. Furthermore, each GDSVIS is internally calibrated to automatically compensate for remaining compliance.

KEY 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 | Earthquake | Embankments & Dams | Frozen Soils | Gas Hydrate | Landslide

DYNAMIC TRIAXIAL TESTING

ENTERPRISE LEVEL DYNAMIC TRIAXIAL TESTING SYSTEM

PRODUCT CODE: ELDYN

The Enterprise Level Dynamic Triaxial Testing System is based on an axially-stiff load frame with a beam mounted electro-mechanical actuator.

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, bender elements, and unsaturated soil testing hardware.

ADVANCED DYNAMIC TRIAXIAL TESTING SYSTEM

PRODUCT CODE: DYNTTS

The Advanced Dynamic Triaxial Testing System is a high-end, no compromise testing apparatus combining a triaxial cell with dynamic actuator. Axial force and deformation are applied through the base of the cell.

KEY FEATURES

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

The Resilient Modulus Testing System enables the resilient modulus and permanent deformation of unbound base/sub-base pavement materials to be determined.

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

The True Triaxial Apparatus can independently control all three principle stresses applied to specimens, allowing a wide range of complex stress paths to be followed. This dynamic cyclic system is powered by advanced electro-mechanical or hydraulic actuators.

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.

Offshore | Pavement & Highways | Piling | Temperature Controlled | Tunnelling

PREFER TO VIEW THE PRODUCTS ONLINE? visit www.gdsinstruments.com

SHEAR TESTING

BACK PRESSURED SHEARBOX

PRODUCT CODE: GDSBPS

The Back Pressured Shearbox has the ability to perform direct shear tests with precise control over the back pressure applied to the specimen.

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

The Dynamic Back Pressured Shearbox is used for static and dynamic direct shear testing of soil specimens while controlling applied back pressure.

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

The Large Automated Direct Shear system is an automated electro-mechanical direct shear testing device for specimens of up to 305mm square in size.

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.

SHEARBASE SYSTEM

PRODUCT CODE: GDSSS

The Shearbase system is an electro-mechanical device that can be configured to conduct direct simple shear or direct shear tests. This is achieved through quick changeover of specimen platens and shearbox.

KEY FEATURES

Desktop apparatus with in-built controllers, resulting in a small 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.

ELECTRO-MECHANICAL DYNAMIC CYCLIC SIMPLE SHEAR

PRODUCT CODE: EMDCSS

The Electro-Mechanical Dynamic Cyclic Simple Shear system is a high-end device designed for advanced direct simple shear testing in commercial and research laboratories.

KEY FEATURES

Electro-mechanical actuators perform tests at up to 5Hz, providing greater accuracies than comparable pneumatic actuators.

Specimens are laterally confined using low friction retaining rings, ensuring a constant cross sectional area is maintained.

Construction | Earthquake | Embankments & Dams | Frozen Soils | Gas Hydrate | Landslide

SHEAR TESTING

VARIABLE DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR

PRODUCT CODE: VDDCSS

The VDDCSS system enables simple shear tests to be performed in any horizontal direction. This is achieved by including a secondary shear actuator that acts at 90 degrees to the primary actuator.

KEY FEATURES

Advanced firmware and synchronisation of the three system actuators enables the shear stress direction to be varied during a dynamic test stage.

Specimens are laterally confined using low friction retaining rings, ensuring a constant cross sectional area is maintained.

MULTIPLE DIRECTION DYNAMIC CYCLIC SIMPLE SHEAR

PRODUCT CODE: MDDCSS

The MDDCSS has all the features of the VDDCSS in terms of control, but with the addition of a pressure confinement cell, the MDDCSS has an additional capability in that pore pressure and therefore effective stress can be accurately controlled.

KEY FEATURES

Test control allows specification of amplitude of horizontal load / displacement as well as direction.

A 6 axis loadcell provides highly accurate internally compensated measurement of all loads.

RING SHEAR APPARATUS

PRODUCT CODE: GDSRSA

The Ring Shear Apparatus is a modern, compact, benchtop, ring shear system, that allows fully automated testing.

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.

INTERFACE SHEAR TESTER

PRODUCT CODE: GDSIST

The Interface Shear Tester is an electro-mechanical device that enables determination of the interface strength between different man-made and geo-materials materials.

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.

Offshore | Pavement & Highways | Piling | Temperature Controlled | Tunnelling

ENVIRONMENTAL TRIAXIAL TESTING

ENVIRONMENTAL TRIAXIAL AUTOMATED SYSTEM

PRODUCT CODE: ETAS

The Environmental Triaxial Automated System is a temperature-controlled load frame-based triaxial system, with options to freeze and heat test specimens.

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.

ENVIRONMENTAL TRIAXIAL TESTING SYSTEM

PRODUCT CODE: ETTS

The Environmental Triaxial Testing System (ETTS) is a temperature-controlled stress path triaxial system, with axial stress directly applied to specimens via a pressure/volume controller.

KEY FEATURES

Specimen cooling and heating are provided using the same methods as the ETAS.

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

Options to include local strain measurement and bender elements are available.

RESONANT COLUMN TESTING

RESONANT COLUMN APPARATUS

PRODUCT CODE: GDSRCA

The Resonant Column Apparatus is a fixed-free Stokoe-type device for measuring the small strain shear modulus degradation and damping ratio of soil and rock specimens.

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

The Hardin Type Resonant Column Apparatus is a system that allows specimens to be confined under anisotropic stress states. This is achieved by a slender, thin walled loading column passing through the drive system to the specimen top-cap.

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.

Construction | Earthquake | Embankments & Dams | Frozen Soils | Gas Hydrate | Landslide

CONSOLIDATION TESTING

AUTOMATIC OEDOMETER SYSTEM

PRODUCT CODE: GDSAOS

The Automatic Oedometer System is the modern replacement for a traditional hanging weight oedometer, with no requirement for a compressed air supply or manually placed weights.

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

The Consolidation Testing System is a state-of-the-art device designed around the Rowe and Barden-type consolidation cell. Two pressure/volume controllers are included to apply vertical stress and back pressure to the specimen.

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

The Constant Rate of Strain Consolidation Cell is a load frame-based system capable of applying back pressures to test specimens. A high pressure (25MPa) and a large diameter (500mm) version is also available.

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.

HOLLOW CYLINDER TESTING

SMALL-STRAIN HOLLOW CYLINDER APPARATUS

PRODUCT CODE: GDSHCA

The GDS Small-Strain Hollow Cylinder Apparatus enables vertical and rotational torque and deformation be applied to a hollow cylindrical soil specimen of soil, allowing the magnitude and direction of the three principal stresses to be controlled.

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.

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PREFER TO VIEW THE PRODUCTS ONLINE? visit www.gdsinstruments.com

ROCK MECHANICS

STATIC TRIAXIAL ROCK TESTING SYSTEM

Up to 500kN

Up to 2MN

PRODUCT CODE: ST-RTS

The Static Triaxial Rock Testing System enables axial load application up to 2MN, with triaxial cells rated up to 100MPa used to confine test specimens of maximum 200mm diameter.

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

The Active Triaxial Rock Testing System allows axial load application up to 2MN via a hydraulically-actuated triaxial cell. Confining pressures up to 64MPa are available for a maximum 150mm test specimen diameter.

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.

DYNAMIC HYDRAULIC LOAD FRAMES

PRODUCT CODE: HLF

The Dynamic Triaxial Rock Testing System can apply axial loads of up to 1.5MN at dynamic frequencies of 20Hz and below. Dynamic loading is achieved using a servo-hydraulic actuator system.

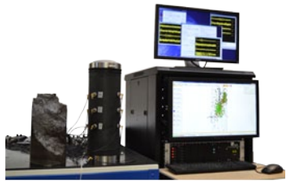
KEY FEATURES

Different load, pressure and specimen sizes available to enable system configuration to specific user requirements.

Can be supplied with a cell top lifting system to provide ease of use when confining test specimens in a high pressure triaxial cell.

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

ACOUSTIC EMISSION



PRODUCT CODE: GDSAE

The Acoustic Emission transducers enable micro-fractures occurring within a rock specimen during testing to be recorded. The submersible transducers may monitor fractures continuously, or only when triggered.

KEY FEATURES

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

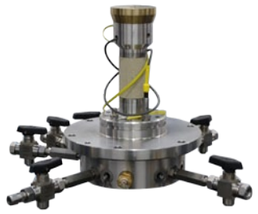
Transducer systems range from simple fracture counters through to complete systems that locate the fracture origin within the specimen.

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

Construction | Earthquake | Embankments & Dams | Frozen Soils | Gas Hydrate | Landslide

ROCK MECHANICS

ACOUSTIC VELOCITY



PRODUCT CODE: GDSAV

The Acoustic Velocity transducers allow P- and S-wave velocities to be measured within a rock specimen. The transducers are mounted in the pedestal and top-cap, or in some cases the sides of the specimen.

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: GDSHC

The Instrumented Hoek Cell is a highly sophisticated version of the traditional Hoek cell, which can be fully instrumented with acoustic velocity and/or acoustic emission transducers.

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

The Large Automated Direct Shear system is an electro-mechanical direct shear testing device for specimens of up to 305mm square in size.

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

The High Pressure Back Pressured Shearbox is a high pressure version of the GDSBPS. Normal and shear loads of up to 100kN may be applied to the test specimen, with a back pressure of up to 10MPa available.

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.

Offshore | Pavement & Highways | Piling | Temperature Controlled | Tunnelling

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PRESSURE/VOLUME CONTROLLERS

ENTERPRISE LEVEL PRESSURE VOLUME CONTROLLER
ELDPC

General purpose water pressure source and volume change gauge. 1MPa pressure rating and 200cm³ 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 200cm³ volumetric capacity. Can also use DigiRFM interface. Typically used in advanced commercial testing and research systems.

ADVANCED PRESSURE VOLUME CONTROLLER
ADVDPC

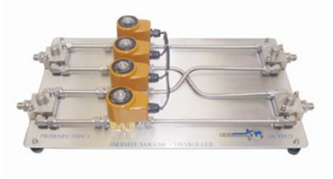
Advanced water pressure source and volume change gauge. Up to 4MPa pressure ratings available in 200cm³ model or up to 2MPa available with 1000cm³ volumetric capacity. Compatible with DigiRFM interface. Typically used in research systems.

HIGH PRESSURE VOLUME CONTROLLERS
HPDPC

Advanced water pressure source and volume change gauge. Capacities from 8MPa up to 100MPa with 200cm³ 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.

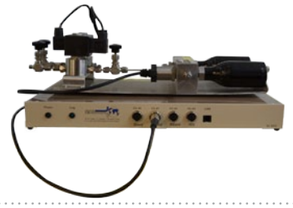


INFINITE VOLUME CONTROLLER
GDSIVC

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.

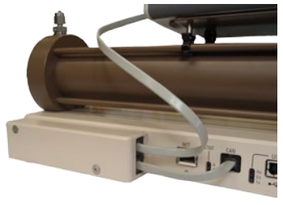
PNEUMATIC PRESSURE CONTROLLER
GDSPPC

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



DUAL PNEUMATIC CONTROLLER
DCHGP

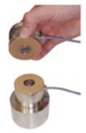
This high pressure gaseous controller has a capacity up to 20MPa. This allows gasses to be used in much higher pressure systems than in traditional systems. Typically used where confining fluid viscosity is of importance such as in resonant columns.



DIGITAL REMOTE FEEDBACK MODULE
DIGIRFM

The DigiRFM allows a remote transducer to be directly connected to the standard and advanced controller ranges. 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 ELEMENTS 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 2MPa or 100MPa version for use in non-conducting oil.

2D LASER SAMPLE MOUNTING SET AND DISPLACEMENT SENSOR
2D-LASER

Monitors the radial profile of a specimen while under test using highly accurate laser precision.

MID PLANE PORE PRESSURE AND MID PLANE SUCTION PROBES
GDSM4P

Provides direct measurement of the pore pressure or suction at the specimen mid-height.

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 ± 1kPa.

LINEAR POTENTIOMETER DISPLACEMENT TRANSDUCER
LPDT

Mounted externally to provide deformation measurements. Body diameter 19mm.

EXTERNAL S-BEAM LOAD CELL
S-BEAM

Mounted externally to provide measurements of force.

FORCE ACTUATOR
GDSFA

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

INTERNAL SUBMERSIBLE LOAD CELL
GDSISLC

Submersible load cells designed for measuring compressive loads ranging from 0.5kN to 100kN. Unaffected by variations in confining pressure.

PORE PRESSURE TRANSDUCER
GDSPPT

Mounted to provide accurate pressure measurements during testing.

PREFER TO VIEW THE PRODUCTS ONLINE? **visit www.gdsinstruments.com**

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.

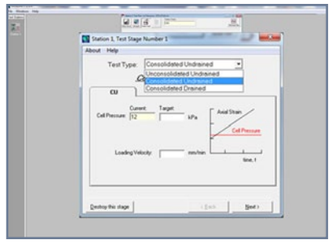
ADVANCED LOADING (USER DEFINED TEST SEQUENCES):
Independent user control over the axial (load, stress or strain), radial and back pressure axes with control options of constant value, ramp or quasi-static sinusoidal cyclic applied separately to each axis.

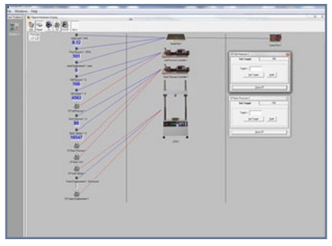
K-ZERO CONTROLLED CONSOLIDATION/SWELLING:
Maintains zero diameter change (K0 conditions) by two methods, either from a direct reading of the specimen diameter or using specimen volume change calculations.

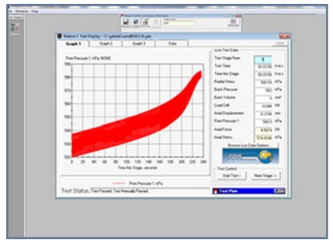
TRIAXIAL PERMEABILITY EVALUATION:
Controls either a constant head permeability test, or a constant flow permeability test with controlled hydraulic gradient control.

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.

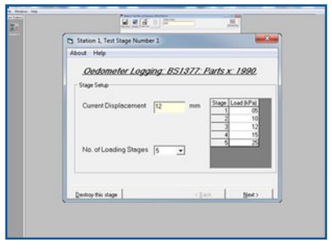


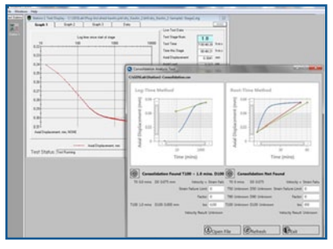




OEDOMETER LOGGING MODULE

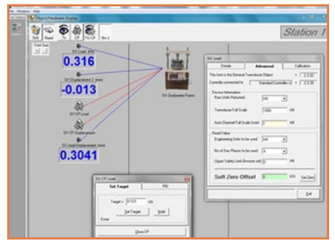
HANGING WEIGHT SYSTEM (OEDOMETER LOGGING):
Uses a datalogger and displacement transducer to take settlement readings from hanging weight oedometer frames.





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.

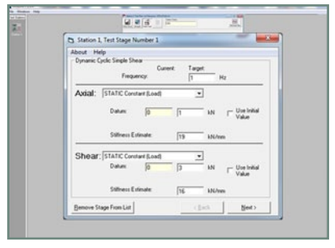


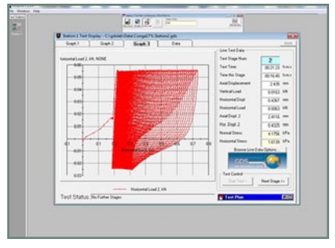
SHEAR TESTING SOFTWARE MODULES

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.



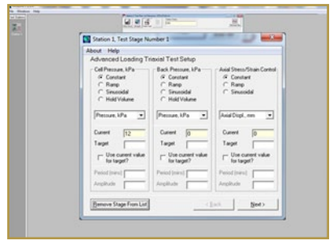


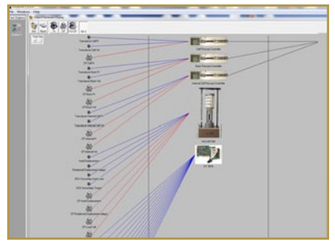
HOLLOW CYLINDER SOFTWARE MODULES

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
- RESILIENT MODULUS SOFTWARE MODULE
- RESONANT COLUMN SOFTWARE MODULE
- GDSLAB REPORTS

LABORATORY SYSTEMS FOR SOIL & ROCK

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