



### Confined Variable Direction Dynamic Cyclic Simple Shear (VDDCSS-CON)

**Overview:** The VDDCSS-CON allows simple shear to be performed in two directions, rather than the standard single. This is achieved by having a secondary shear actuator that acts at 90 degrees to the primary shear actuator. The VDDCSS-CON also allows the application of a confining pressure to the sample. The sample carriages are encased within an acrylic pressure cell. The application of confining pressure also allows back pressure to be applied to test specimens. This allows specimens to be back-pressure saturated, with excess pore pressures directly recorded during simple shear tests. When used as a variable direction machine, the secondary shear axis can be used independently of the other shear axis or in conjunction, therefore simple shear may be performed in any horizontal direction.

#### Key Features:

#### Benefits to the User:

Test control:	Test control allows specification of amplitude of horizontal load / displacement as well as direction.
Direction of shear and pattern of shear rotation from zero degrees can be defined:	<ul style="list-style-type: none"> <li>• Constant at zero degrees.</li> <li>• Rotate from zero degrees at a constant rate.</li> <li>• Cycles from zero degrees plus or minus x degrees with period in seconds.</li> <li>• Angles relative to zero e.g. 0, 10, 20, 30 etc. Definition of waveform by datum/common point, amplitude, controlling parameter and frequency.</li> </ul>
Teflon coated rings:	K-zero conditions ensured by use of 1.1mm high, low-friction, PTFE coated rings.
6 Axis Loadcell:	Highly accurate internally compensated measurement of all loads.
Independent axis control:	Each axis can be load or displacement controlled.
Local strain LVDT's for both directions:	Highly accurate strain measurement.
Pressure control:	Confining pressure up to 1MPa is applied by water and controlled using a Pneumatic Controller (GDSPPC) through a direct air/water interface within the cell. A second pressure controller is used to apply back pressure.
Pore water pressure Transducer:	Highly accurate measurement of pore water pressure in all stages of testing.

**Tests that can be Performed:** Cyclic loading of samples under either load or strain, Cyclic Simple Shear, Dynamic Cyclic Axial Stress Capability, K0 (K-Zero), Oedometer / Consolidation, Quasi-Static (low speed/creep) Tests, Simple Shear, Cyclic Testing, Slow, Stepped Loading, Axial Compression, Variable Direct Simple Shear, Load Control (Dynamic), Load Control (Static), Maximum Shear modulus, Static Displacement, Static Load & Constant Normal Stiffness.

**Upgrade Options:** Bender Elements.

#### Technical Specification:

<b>Confining Pressure:</b>	1MPa
<b>Actuators:</b>	3 x electro-mechanical, high accuracy, encoder controlled actuators
<b>Force Accuracy:</b>	±0.1%
<b>Load Range:</b>	10kN Axial Axis, 5kN Shear Axis
<b>Displacement Range:</b>	Shear axis ±20mm Normal axis ± 25mm
<b>Displacement Resolution:</b>	0.1µm
<b>Weights &amp; Dims:</b>	650kg, 2.3 x 0.9 x 0.9m
<b>Operating Frequency:</b>	0 (static) to 1Hz
<b>Sample Size:</b>	50,100mm diameter

### Applications:

The VDDCSS-CON provides a system for testing soils which, may undergo shear loadings that change direction over time. This includes a variety of offshore foundations for structures such as wind turbines and oil rigs.

The VDDCSS-CON can also model situations which, bias in one direction and load in the other. An example of this is near-field seismic motions.



### System Set-up:

#### Software:

Connection to the testing PC is via a single USB cable allowing simple system setup. Control and acquisition are managed using GDSLAB offering a familiar interface across all GDS systems.

#### Stress:

The VDDCSS-CON has been developed to allow effective stress controlled bi-directional simple shear tests. The system can be used with or without cell pressure. This allows for true undrained effective stress based tests which are more commonly performed in research applications, as well as ring-bound drained simple shear tests, to be performed such as those described under ASTM D6528.



#### Electromechanical:

The VDDCSS-CON is an electromechanically actuated system which provides 3 axes of dynamic control. The system does not require hydraulic powerpacks or a pneumatic supply for the dynamic actuation.

#### Upgrade:

The VDDCSS-CON platens can be upgraded to use bender elements. Spare access ring ports are available for additional transducers such as temperature sensors or local pore pressure. Sample sets are available up to 100mm.

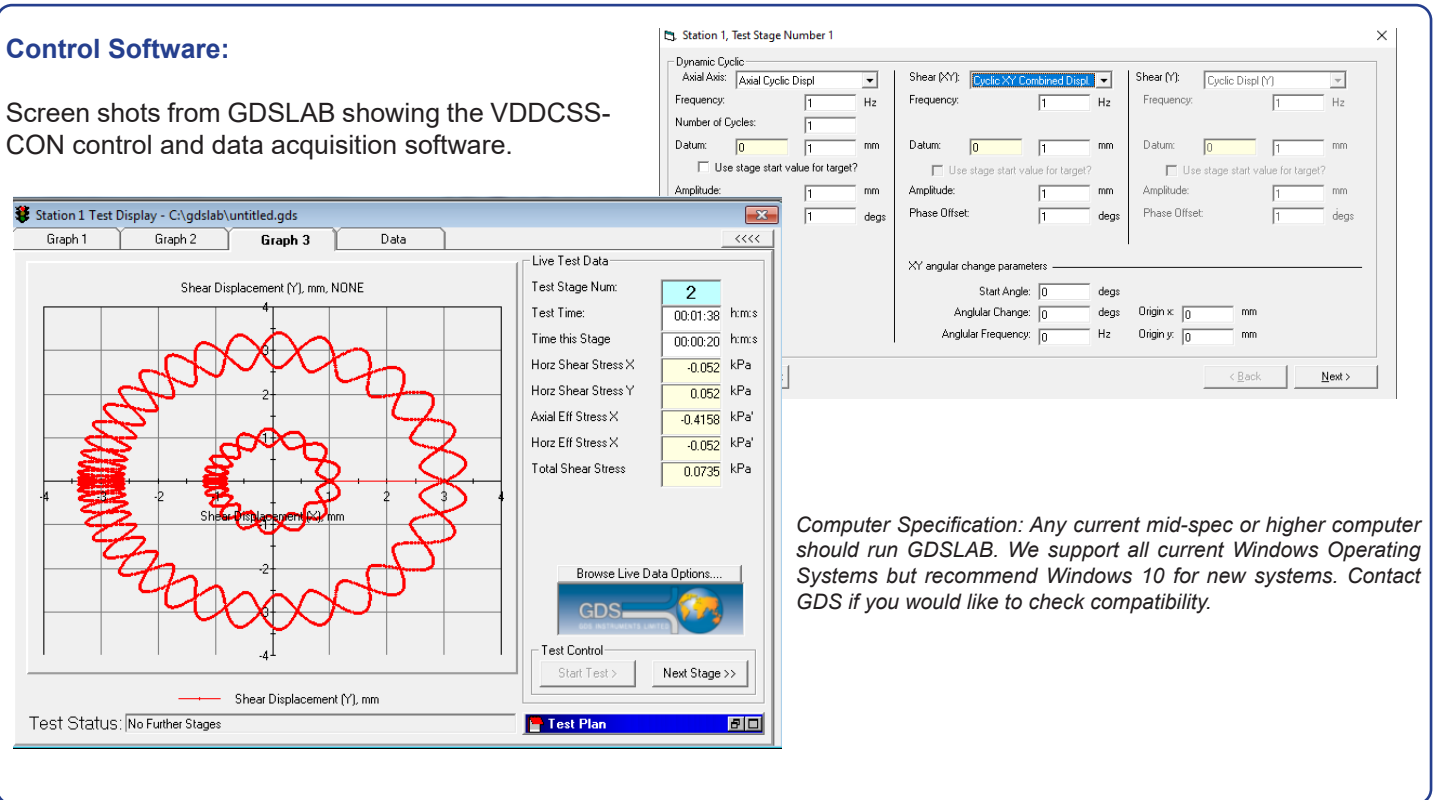
For delicate samples a sliding placement jog is available to gently position the sample and pedestal in place.

### Tests that can be Performed:

Dynamic simple shear and dynamic variable direct simple shear.

### Control Software:

Screen shots from GDSLAB showing the VDDCSS-CON control and data acquisition software.



The screenshot displays the GDSLAB control software interface. On the left, a graph titled 'Station 1 Test Display - C:\gds\lab\untitled.gds' shows 'Shear Displacement (Y), mm, NONE' on the y-axis and 'Shear Displacement (X), mm' on the x-axis. The graph displays a red, complex, multi-lobed waveform. Below the graph, the 'Test Status' is 'No Further Stages'. On the right, a 'Live Test Data' panel shows the following values:

Test Stage Num:	2
Test Time:	00:01:38 h:m:s
Time this Stage:	00:00:20 h:m:s
Horz Shear Stress X:	-0.052 kPa
Horz Shear Stress Y:	0.052 kPa
Axial Eff Stress X:	-0.4158 kPa'
Horz Eff Stress X:	-0.052 kPa'
Total Shear Stress:	0.0735 kPa

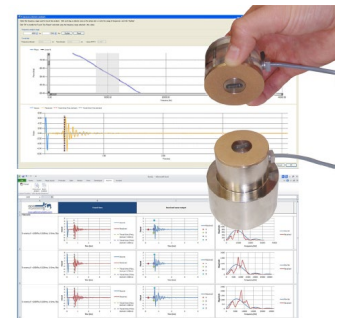
Below the data panel are 'Test Control' buttons: 'Start Test >' and 'Next Stage >>'. To the right of the main interface is a 'Station 1, Test Stage Number 1' control panel with various input fields for 'Dynamic Cyclic' and 'Shear (XY)' parameters, including Frequency, Number of Cycles, Datum, Amplitude, and Phase Offset.

*Computer Specification: Any current mid-spec or higher computer should run GDSLAB. We support all current Windows Operating Systems but recommend Windows 10 for new systems. Contact GDS if you would like to check compatibility.*

### Upgrade to Bender Element Testing:

The VDDCSS-CON can be upgraded to perform P and S wave bender element testing with the addition of the following items:

- Bender element pedestal with bender element insert.
- Bender element top-cap with bender element insert.
- GDS high-speed data acquisition system.  
Signal conditioning unit which includes amplification of source and received signals (P and S wave) with user controlled gain levels (via software).
- GDS Bender Element Analysis Tool GDSBEAT (optional).



Screenshots of GDSBEAT software.



### ADVDCS v2 Acquisition Pad Used with VDDCSS-CON

**Overview:** The ADVDCS v2 is a modern high speed digital control and acquisition system developed especially for geotechnical testing, and is the premier device in the GDS range, typically supplied with our most advanced dynamic test and control systems. The ADVDCS v2 has been fully

designed and developed by GDS' in-house engineering team.

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.

The ADVDCS v2 is the direct result of GDS research into high accuracy dynamic control, 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.

### Technical Specification:

<b>Connection to PC:</b>	USB
<b>Acquisition Channels:</b>	8 Analogue + 1 Quadrature Decoder
<b>Control Channels:</b>	2 (Analogue or digital)
<b>Multi Box Capability:</b>	x4
<b>Max Number of Channels:</b>	Up to 32 analogue + 4 quadrature channels with synchronised data acquisition
<b>Sample Rate:</b>	5kHz
<b>Resolution:</b>	24 bit, 16,777,216
<b>Gain Ranges:</b>	8 (User defined in software)
<b>Description:</b>	Advanced level solution for the highest performance of dynamic acquisition & control
<b>Voltage Resolution:</b>	~ 0.000001 mVolts (1 nanovolt)
<b>Voltage Input Type:</b>	Fully Differential, Balanced Precision Inputs with Integrated Signal Conditioning
<b>Transducer Excitation Voltage:</b>	Differential, Fixed Precision +/-5V, Independent (not Ganged), Ratiometric Excitation
<b>Number of Input Ranges:</b>	8 Independently Selectable Ranges Per Channel from (-10...+10mV) to (-10...+10V)
<b>Excitation Current Sense:</b>	Yes - can monitor transducer currents - alerts user of disconnected transducers
<b>Excitation/Transducer Fault Detection:</b>	Overvoltage, Overcurrent, Absent Transducer
<b>Excitation Fault Tolerance:</b>	Independent Per Channel, if any channel is shorted the other channels will continue to operate normally
<b>Current Input Mode:</b>	Yes - Via resistor fitted in cable termination (different ranges possible)
<b>Differential Measurement Range:</b>	-10mV...+10mV up to -10V...+10V for balanced differential signals
<b>Transducer Calibration:</b>	Linear, polynomial and custom transducer calibration
<b>Virtual Transducers:</b>	Up to 32 virtual transducers (e.g. strain, compliance, calculated values)
<b>Data Acquisition Options:</b>	Digital filtering for noise reduction
<b>Digital Control:</b>	1 kHz 32-bit floating point control loop
<b>Analogue Control:</b>	Control of both digital and analogue motor drives possible
<b>Compliance Estimation:</b>	Real time specimen compliance estimation
<b>Adaptive Control:</b>	Adaptive load and stress control
<b>Custom Waveforms:</b>	Custom waveform control with a maximum of 16000 points per waveform
<b>Sample Docking:</b>	Automatic sample docking
<b>Display and Monitoring:</b>	Data acquisition in GDSLab via USB interface, High resolution real time graphs
<b>Software:</b>	GDSLAB
<b>System Characteristics:</b>	200 MHz dual core ARM Cortex-M4 CPU, 32-bit architecture, On-board flash memory, 480 Mbit/s USB connection
<b>Minimum System Requirements:</b>	OS: Windows 7 or later, CPU: 1.5 GHz or higher, Memory: 2 GB, USB 2.0

## Why Buy GDS?

### GDS have supplied equipment to over 86% of the world's top 50 Universities:

GDS have supplied equipment to over 86% of the world's top 50 Universities who specialise in Civil & Structural Engineering, according to the "QS World University Ranking 2020" report.

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

**TOP  
50**

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

**100% of our customers answered "YES"**

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



### Made in the UK:

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

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

**40 YEARS OF  
BRITISH  
INNOVATION**



### Extended Warranties:

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



### GDS Training & Installation:

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



### Technical Support:

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

