About GDS Instruments

GDS Instruments (Geotechnical Digital Systems, or simply GDS) designs, develops and manufactures material testing machines and software used for the computer-controlled testing of soils and rocks. This technology is used to evaluate the mechanical properties that are key in geotechnical and earthquake engineering design.

Since being founded in 1979, it is estimated that GDS products have been used to help achieve over 1000 PhD’s. As well as being the first choice for academic research, GDS products have been used in many world renowned commercial laboratories for projects including the Three Gorges Dam in China, the Millau Viaduct in France, the Vasco da Gama Bridge in Portugal, Terminal Five at Heathrow and the new Crossrail link in London.

GDS employs over 35 permanent members of staff at their offices in Hook, Hampshire, UK, as well as working with a network of agents spanning 40 countries. GDS UK based staff include 3 PhD’s, 8 qualified civil / geotechnical engineers, 4 software designers, 4 hardware designers and 5 electrical/electronics specialists, allowing GDS the capability to design, build, test and ship their products directly to the customer.

In 2011 GDS were awarded the prestigious Queens Award for “Enterprise in International Trade”.

Values at GDS

GDS believes in providing the best equipment for the job combined with first class support from engineers who understand the equipment and applications. GDS design and develop all their products in-house using their team of geotechnical engineers, software designers, hardware designers (3D CAD) and electrical/electronics designers and specialists. This allows GDS to have complete control of the design, build, test and shipping process. GDS’ in-house expertise allows the capability to design bespoke systems (hardware, electronics and software), which forms a significant part of GDS’ reputation.

GDSLAB software supports every GDS computer controlled device manufactured since 1979, as well as devices from other manufacturers that have long since been made obsolete by them. This forms part of our unique commitment to long term customer support.

When you receive training from or ask a technical question of GDS, your reply will be from, or via a geotechnical engineer. This is our philosophy for ensuring the best service possible. Great service = repeat customers and we have many repeat customers.

GDS production and manufacturing is carried out in the UK to strict quality standards and our management systems are ISO9001 accredited.

GDS Customers

GDS work closely with Research and Commercial companies. Utilising our network of agents has allowed GDS to work in many countries around the world and become involved with some world renowned organisations / institutes on a variety of different projects.

Please Note: Due to continued developments, specifications of products within this brochure may change.
Introduction to GDS Resonant Column and Hollow Cylinder Apparatus

Resonant Column

The GDS Resonant Column Apparatus (GDSRCA), is used to excite one end of a confined solid or hollow cylindrical soil specimen. From the resonant frequency, small strain stiffness can be found. The GDSRCA is used by advanced commercial laboratories and Universities for performing research.

GDSRCA systems are current driven using a transconductance power amplifier. This is an advantage due to the fact that impedance of the RCA system changes with frequency. At higher frequencies, using a constant voltage, the current would be seen to reduce. As the torque is directly proportional to current, the torque would also reduce. This change to using a current driven power amplifier reflects the current thinking in the state-of-the-art resonant column testing throughout the world and ensures constant torque is applied at all frequencies.

Options exist for an environmental temperature chamber (-20 degs C to +40 degs C) and an axial loading actuator and frame.

GDS can also supply a Hardin Oscillator type RCA which, is suitable for anisotropic loading.

Hollow Cylinder

The GDS Small-Strain Hollow Cylinder Apparatus (SS-HCA), allows for rotational displacement or torque to be applied to a hollow cylindrical specimen of soil. Using this device it is possible to control the magnitude and direction of the three principal stresses within a soil specimen.

The SS-HCA s (static) and SS-HCA d (dynamic) are both designed around the same central core of components. All of these components have been designed to give the machine high levels of axial and torsional stiffness coupled with the minimum amount of “backlash” and friction. All of these design considerations result in both machines being well suited for small strain testing through to high strain testing.

For example studies can be made of the following:

- The anisotropy of soil samples.
- The effects of principal stress rotation.
- The effects of intermediate principal stress.
Resonant Column (GDSRCA)

**Overview:** The GDS Resonant Column Apparatus (GDSRCA) is a true fixed free resonant column where one end of a confined solid or hollow cylindrical soil specimen is excited and the other is fixed.

From the resonant frequency, small strain stiffness can be found. GDSRCAs are used by advanced commercial laboratories and Universities for performing research.

<table>
<thead>
<tr>
<th>Key Features:</th>
<th>Benefits to the User:</th>
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<tbody>
<tr>
<td>RCA systems that GDS supplies are current driven using a transconductance power amplifier:</td>
<td>This is because the impedance of magnet / coil devices change with frequency. At higher frequencies, using a constant voltage amplifier the current would be seen to reduce. As the torque is directly proportional to current, the torque will also reduce and a non-linear torque input would affect results. This effect is removed in the GDSRCA by using a current driven power amplifier.</td>
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<tr>
<td>Designed to provide maximum rigidity:</td>
<td>Providing minimum losses and a more consistent frequency response and no rigid support to the top cap so it is completely free vibrating.</td>
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<tr>
<td>Dedicated GDS RCA software is used for control and data acquisition of the RCA apparatus:</td>
<td>Simple automated tests.</td>
</tr>
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<td>Low equipment damping:</td>
<td>The software switches the hardware to provide an 'open circuit' through the coils during free vibration decay, which prevents 'back' EMF generation and reduces equipment damping effects.</td>
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<tr>
<td>Electro-magnetic drive system:</td>
<td>Which incorporates precision wound coils and composite sintered neodymium iron boron (NdFeB) &quot;rare-earth&quot; magnets.</td>
</tr>
<tr>
<td>Internally mounted, counter-balanced accelerometer:</td>
<td>Used to measure vibratory response of the sample.</td>
</tr>
<tr>
<td>Internal cell:</td>
<td>To surround sample with water, to avoid air penetrating the membrane.</td>
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**Tests that can be Performed:**
Damping ratio in flexure, damping ratio in torsion, resonance in flexure, resonance in torsion and optional slow speed (<2Hz) torsional shear.

**Upgrade Options:**
Lifting frame for easy cell top removal, vertical bender elements (S and P wave), unsaturated RCA testing pedestals, torsional shear upgrade using non-contacting proximetor transducer, high pressure upgrades from 1MPa (standard) to 2MPa, 3MPa or 25MPa, anisotropic test upgrade (hanging weights), gas hydrate upgrade option, unsaturated testing (Method A and B), option for environmental temperature chamber (-20 degs C to +40 degs C), an axial loading actuator and frame and a Hardin Oscillator type actuator with axial force actuator.

**Technical Specification:**

<table>
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<tr>
<th>Frequency Range (Hz):</th>
<th>300</th>
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<tbody>
<tr>
<td>Pressure Range (MPa):</td>
<td>1 standard, 2, 3 and 25 as options</td>
</tr>
<tr>
<td>Sample Sizes (mm):</td>
<td>50, 70, optionally 100</td>
</tr>
</tbody>
</table>
**Overview:** The GDS Small-Strain Hollow Cylinder Apparatus (SS-HCA) allows for rotational displacement and torque to be applied to a hollow cylindrical specimen of soil. Using this device it is possible to control the magnitude and direction of the three principal stresses.

Two version of the system are available, SS-HCA s (static) and SS-HCA d (dynamic).

### Key Features:
- Both systems exhibit high levels of axial and torsional stiffness coupled with the minimum amount of “backlash” and friction.
- Flexibility in the capacity of the system: Specimen size, load, pressures can be chosen to ensure the system is created specifically to suit the testing required and the budget.
- Balanced ram: Allows a static pressure controller to be used for cell pressures with no significant fluctuations of cell pressure during dynamic tests.
- Submersible, interchangeable combined axial / torque loadcell: Measures axial load/torque with no errors introduced due to friction on the loading ram.
- Cell top lift frame: For ease of use when lifting the cell top, comes as standard.

### Tests that can be Performed:
HCA generalised stress path (P, Q, B, α), advanced HCA loading procedures and dynamic HCA loading. Triaxial testing with optional items.

### Upgrade Options:
Sample sizes, transducers, celltop counter balanced lift, optional large cell for 200mm samples, internal bore LVDT, outside diameter non-contacting proximetrors and unsaturated testing.

### Technical Specification:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td>Axial Displacement Encoder</td>
<td>&lt;1μm</td>
</tr>
<tr>
<td>Axial Load Resolution</td>
<td>0.3N (for 10kN systems)</td>
</tr>
<tr>
<td>Axial/Torque Force Range</td>
<td>10kN/200Nm, 12kN/200Nm, 15kN/400Nm</td>
</tr>
<tr>
<td>Torque Resolution</td>
<td>0.06kN (200kN Systems)</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>700 X 700 X 1000 (cell de-mounted), 1450 (cell mounted), 2350 with cell top lifting frame</td>
</tr>
<tr>
<td>Load Range (kN)</td>
<td>10, 12 or 15</td>
</tr>
<tr>
<td>Operating Frequency (Hz)</td>
<td>0.5, 1, 2 or 5</td>
</tr>
<tr>
<td>Pressure Range (MPa)</td>
<td>1, 2</td>
</tr>
<tr>
<td>Sample Sizes (mm)</td>
<td>100/60/200 or 200/160/400 (OD, ID, height)</td>
</tr>
<tr>
<td>Weight Approx (kg)</td>
<td>500</td>
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</table>
Customer Testimonials

Read a sample of our customers feedback below.

“I would like to thank you personally for your outstanding support, control, demonstration and training of the ELDYN. Working more than 12 hours per day with you and with Orestis (NEOTEK) we learnt a lot and we are all grateful for your efforts and dedications. It truly made a difference! Thank you very much!”

“I have been dealing with GDS Instruments for more than 10 years in the UK and Canada. During my dealings with the company they have been highly professional, providing excellent service and products. We have compared the products and service from a number of other vendors as part of our purchasing procedures, using a range of metrics and GDS consistently out perform their competitors. Their maintenance procedures and after sales service are also excellent. I have no hesitation in recommending GDS Instruments for soil testing instrumentation and apparatus.”

“I have had an exceptional experience with GDS. I was hired in 2003 to bring a geotechnical lab back to life after 5 years of inactivity. Through the unbelievable technical support and because of the quality of GDS’s products the original advanced triaxial system purchased in 1989 is working without a problem. I continue to use GDS and have confidence that their products will provide me with high quality data. The service and products provided by GDS are simply second to none.”

“Your technical support has been exceptional, rapid, detailed, and on target, even for a small customer like me. Please feel free to pass along my contact information to whomever you wish.”

“I have used GDS’s LVDT (Local Strain Transducers) system to study Chicago clay samples for the past three years at Northwestern. The LVDT system allowed me to measure the strains directly on my test specimen. By using it, I could minimize uncertainties in interpretation from apparatus compliance, tilting of the specimen and the imperfect platen-sample bedding. Furthermore, the accuracy, precision and resolution level of the device are one of the major factors in my successful research. I can recommend GDS’ LVDT’s as a reliable internal measurement device.

“I must say that I have had an excellent experience with GDS. All of your staff have been extremely helpful and responsive to all of my requests. When I originally purchased the Bender Element accessories, the GDS staff did an excellent job in providing shop drawings and manuals to be used in modifying my existing triaxial system. I will certainly be using GDS again in the future. Thank you for your past assistance.”

“My first purchase was based on reference from a colleague; since then I have continued to purchase from GDS because, mainly, of the attention to detail and flexibility in system design, as well as tailored customer service for hardware and software.”

“I wish all instrument companies I dealt with were as responsive and capable as GDS.”

“I am very happy to provide a reference. You guys are *stars*! I am a minor GDS customer, but you have always been extremely supportive, knowledgeable, and speedy in helping me with questions.”

“FYI - we are currently testing more samples in our GDS-based system, this will be the 5th student to do a thesis using your equipment in my lab.”

“Thanks very much for the information. The support and service from GDS is excellent and very much appreciated.”

“I would very much like to stay in touch as I am sure we can do business again. I am always impressed with the professionalism of the team at GDS”.

“I would like to thank you for the outstanding service regarding to the pressure-volume controller.”

“I will happily confirm the quality and function of the equipment, as well as prompt and very professional support!”

“Thank you very much, and I am certainly pleased to be doing business with GDS Instruments.”