



### Hardin Oscillator (H-RCA)

**Overview:** Hardin Type Resonant Column Apparatus (H-RCA) is a system that allows samples to be tested in resonance while maintaining an anisotropic loading up to 2kN. This is achieved by a slender, thin walled loading column passing through the drive system to the topcap. The GDS Hardin Oscillator contains an electro-magnetic drive system incorporating precision wound coils and composite sintered neodymium iron boron (NdFeB) “rare-earth” magnets.

The GDS Hardin Oscillator can be mounted in a standalone system with an integral axial force actuator (shown opposite) for post resonance testing up to 5kN.

#### Key Features:

#### Benefits to the User:

Hardin Type Oscillator:	The specific benefit of the Hardin Oscillator is the ability to perform torsional resonance anisotropically.
Hardin Oscillator can be loaded beyond its useable load:	The Hardin head is designed to be able to apply up to 2kN axial force whilst still being able to perform resonance tests. The GDS head is designed such that the Hardin cell can be loaded beyond this value to 5kN allowing a full suite of triaxial tests to be performed to shearing post resonance.
Post resonance maximum axial load of 5kN (top actuator):	The 5kN max load system has an actuator built into the top of the cell. The cell is a hybrid style cell that allows the cell wall to be lifted clear of the sample while the top-cap is supported in place for easy and accurate sample installation and alignment.
Integrated reaction mass:	The reaction mass is integrated into the drive system so it is as close to the force generation as possible. This eliminates uncertainties due to transferal of forces.
Current driven using a transconductance power amplifier:	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.
Dedicated GDS RCA software is used for control and data acquisition:	Simple automated tests allow tests to be consistent.

#### Technical Specification:

Accuracy of Pressure Measurement:	0.15% FRO
Pressure Range:	1, 2MPa
Load Range for Resonance:	2kN
Load Range post Resonance:	5kN (top actuator)
Sample sizes (diameter):	50, 70 or 100mm
Axial Stroke:	50mm (2kN version)
Operating Frequency:	0-300Hz
Dimensions:	1005mm (H), 330mm (W) (500mm with valves)
Weight:	128kg (Approx)
Lifting Frame	As standard

#### Optional Extras:

Vertical Bender Elements	50, 70mm
Torsional Shear (slow speed torsional shear test) upgrade	1 MPa only

## USB 8 Channel Logger Used in H-RCA



**Overview:** The USB 8 channel logger is a 24 bit digital acquisition system developed specifically for use with transducers likely to be used in a geotechnical laboratory.

The device provides eight fully independent channels of simultaneously sampled ultra-high resolution 24-bit data. Each channel has 22 software selectable gain ranges, precision ratiometric transducer excitation, and industry standard DIN connection allows the full-range of GDS transducers to be quickly and easily connected and configured.

A standard USB Interface provides direct PC connectivity and is fully supported by the GDSLab test software allowing seamless integration into new and existing test setups. With the ability to connect multiple USB Pads per PC it is possible to build, expand and customise data acquisition systems by using multiple devices to suit requirements.

### Technical Specification:

<b>Connection to PC:</b>	USB
<b>Acquisition Channels:</b>	8
<b>Multi Box Capability:</b>	x10
<b>Max Number of Channels:</b>	Up to 80
<b>Sample Rate:</b>	500Hz*
<b>Resolution:</b>	24 Bit: 16,777,216
<b>Gain Ranges:</b>	22 (User defined in software)
<b>Description:</b>	For use on all static systems where logging is usually 1 point every 2 seconds or slower. *Can be configured to acquire data up to 500Hz only in certain hardware configurations.
<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>	22 Independently Selectable Ranges Per Channel from (-22...+22mV) to (-11.63...+11.63V)
<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>	-22...+22mV to -11.63...+11.63V for balanced differential signals
<b>Transducer Calibration:</b>	Linear
<b>Data Acquisition Options:</b>	Digital filtering for noise reduction
<b>Sample Docking:</b>	Manual
<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.

