Automatic Oedometer System (GDSAOS)

The GDS Automatic Oedometer System (GDSAOS) is the modern replacement for a traditional hanging weight oedometer. The GDSAOS is a self-contained stepper motor driven unit that can be controlled either manually using its Smart Keypad or from a PC using the USB interface. There is no requirement for compressed air or manually placed weights. When used with the GDSLAB control and data acquisition software, the GDSAOS can be used for a complete array of tests beyond those which a hanging weight oedometer can perform.

The GDSAOS is available with a standard or long-stroke frame both of which can be upgraded to perform constant rate of strain and unconfined compressive strength testing.

Key Features:

| Automatic transition between test increments for all soil types, with no need of user estimated parameters input during test set-up: | Results from tests on over consolidated clay, produced a reduction in test duration of 42%. |
| Direct replacement for a hanging weight oedometer system: | The GDSAOS is a stand-alone unit (with no requirement for compressed air). Having a small footprint significantly reduces the bench space required coupled with the additional advantage that loading weights are not required. |
| Automated logging of data (and optionally reporting): | Automation saves time recording results and controlling the test. |
| Incremental loading stages: | When using GDSLAB the GDSAOS can be preprogrammed to include numerous incremental loading stages which automatically move to the next stage via preprogrammed end of consolidation conditions, thus increasing sample throughput. |
| Accurate results throughout the load range: | From 1N to 10kN the GDSAOS electro-mechanical pressure controlled systems provide accurate results, compared to pneumatic consolidation systems that are typically inaccurate at low loads. |
| Utilise existing equipment: | If upgrading from a PC logged hanging weight system, it may be possible to utilise the current data logger and transducers as many data loggers, even those from other manufacturers, are compatible with the GDSLAB software. |

Upgrade Options:

- Upgrade to CRS testing frame. This has wider bars and beams to allow the CRS cell to fit.
- External displacement transducer – Increases the accuracy of strain measurements (generally required to comply with national standards).
- Add an RFM, this device can measure and control from an additional transducer, i.e. axial displacement or pore pressure.
- Bender Elements System.

Technical Specification:

| Axial Force Accuracy: | 0.1%FRO |
| Dimensions: | W/D/H - 220mm, 180mm (260mm including keypad), 485mm |
| Displacement Accuracy: | 0.1% - dependent on transducer selected |
| Displacement Resolution: | 0.0003mm - dependent on transducer selected |
| Load Range: | Max Load 10kN |
| Power: | 110 to 240 AC Volt Input, 60Watts |
| Sample Sizes: | 50, 63.5, 71.4, 75, 101.6 & 112.8 mm (Other sizes available by request). |
World leaders in the manufacture of laboratory systems for soil & rock

Fig 1. Standard Oedometer test setup

No Hanging Weights

In its simplest form, the AOS frame with oedometer cell provides a force control unit with displacement measurements taken from the platen movement. In this way it can be used as a direct replacement for a traditional hanging weight oedometer frame.

Loading

Loading can be applied directly through the keypad with measured load and measured displacement recorded manually as with a traditional oedometer frame. This simple method may be applicable to teaching laboratories and avoids students handling heavy weights and the associated Health and Safety implications.

Multiple cell systems:

The GDSAOS can be arranged in greater numbers connected to a single PC or to multiple PCs. Commonly oedometers are used in groups of 4-6 and these can all be connected to GDSLAB and controlled with tests starting at different times and differing load increments.

GDSLAB Software: Fully Automated Control & Acquisition

The greatest benefits of the GDSAOS are realised when the AOS is fully automated for control and acquisition with the following options:

- GDSLAB with the Oedometer module – Automated testing (step loading) and data acquisition.
- External Displacement transducer – Increases the accuracy of strain measurements (generally required to comply with national standards). The recommended transducer is a USB digital dial gauge for simplicity, ease of use, and the reassurance of a reading on the transducer.

Note: If upgrading from a PC logged hanging weight system, it may be possible to utilise the current data logger and transducers as many data loggers, even those from other manufacturers, are compatible with the GDSLAB software.

Fig 1. Typical multiple cell set-up.
The nominal travel is increased to 50mm in the long-stroke frame. While this is typically used for unconfined testing the same frame could also be used for Oedometer or CRS consolidation testing. The taller columns used also allow for a taller specimen to be tested. Using the UCS sample set shown below specimens up to 250mm height can be tested.

**Compact Size**

The long-stroke frame has a compact footprint (22x18.5cm plus cables and keypad) and is 66cm tall. The complete set up shown including unconfined compression sample set weighs only 18.5kg, making it a very compact and portable system.

**Unconfined Compression Testing**

This system can be used to perform unconfined compression in accordance with ASTM D-2166 and CEN ISO/TS 17892-7. With additional sample sets the same frame can also be used for oedometer or CRS consolidation tests.

**External “S-Beam” Load Cells**

An s-beam loadcell is calibrated with the frame for closed loop control of force applied. A 10kN loadcell is supplied as standard – smaller ranges are available to maximise accuracy if lower loads are expected.

**Displacement Transducers**

There are three common methods for measuring displacement with this frame. First is to fit an LVDT via DigiRFM for closed loop control and logging of the external displacement. The second option is to use an external digital dial gauge to log the applied displacements. Finally the frame’s internal motor displacement can also be logged and controlled on.

**Additional equipment required to carry out CRS testing in a long-stroke frame:**

- Frame upgrade if not chosen at purchase.
- A GDS CRS cell (1MPa or 3MPa).
- A CRS cell sample set (these are interchangeable to allow testing of different sample sizes within the same cell).
- Optional internal submersible loadcell (to remove seal friction effects on the loading ram).
- Back pressure controller (1MPa or 3MPa).
- Pore pressure transducer.
- Data acquisition device.
Further Advanced Testing Options

Displacement Control: There are two different types of external displacement transducer available. The most common solution is to use a digital dial gauge with direct USB connection to the PC. Using GDSLAB software, a closed loop system is created using feedback from this transducer to the software which in turn controls the AOS frame.

A USB Digital Dial Gauge with a 12.5mm stroke, resolution of 0.001mm and maximum error of 0.005mm is offered (equivalent to 0.04% error of the 12.5mm stroke).

Where connectivity to the PC is not possible or not desirable, a displacement transducer may be connected directly to the GDSAOS frame via a Remote Feedback Module (RFM). The closed loop control is now within the AOS frame itself. The advantage of the RFM solution as well as minimising the number of connections to the PC, is that closed loop control may be achieved stand alone without the use of a control PC.

A high accuracy (<0.1% FRO) LVDT can be offered in either ±5mm, ±7.5mm or ±10mm ranges for use with the RFM.

Constant Rate of Strain

Constant rate of strain consolidation with pore pressure control (back pressure) and pore pressure measurement is possible allowing one dimensional consolidation to be achieved faster than using weights or stepped loading tests. CRS cannot be performed with hanging weight oedometers or with pneumatically actuated automated oedometer systems. Fast loading with low impact of the sample is possible due to the direct drive screw design.

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- Back pressure controller (1MPa or 3MPa).
- Pore pressure transducer
- Data acquisition device

Permeability Testing

A Fixed ring permeability consolidation cell is available to fit the GDSAOS.

Additional equipment required to carry out Fixed Ring Permeability testing:
- A Fixed Ring Permeability Cell
- 2 off GDS Pressure Volume controllers
- GDSLAB Permeability Module

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Technical Support:
GDS provide comprehensive on-site product training and installation. GDS understand the need for ongoing after sales support, so much so that they have their own dedicated customer support centre. The support centre allows the user to log queries, download helpsheets and get the latest information on product updates. The site is fully searchable and provides a great resource to customers.

Alongside their support centre GDS use a variety of additional support methods including...

- **Remote PC Support**: Remote PC support works by GDS providing a secure link to a customers PC, thereby allowing GDS to take control. Once in control of the PC, GDS can help with any problems associated to software, installation, testing etc.
- **Product Helpsheets**: The helpsheets are the GDS FAQ documents. They cover a multitude of hardware and software questions and are free to download from our online support centre.
- **YouTube Channel**: GDS YouTube channel holds both software and hardware video’s aimed to give you better understanding of how the products work.
- **Email & Telephone Support**: If you prefer you can email requests to support@gdsinstruments.com where they will be automatically added to the support system and then allocated to a support engineer.

**GDS Awarded Queens Award for Enterprise in International Trade:**

GDS have been presented with the most prestigious corporate award made in the UK – The Queen’s Award for Enterprise in the International Trade category. GDS are delighted to have won the award which has been given to GDS for increasing overseas trade by 190% over six years of continuous sustained growth, and for selling over 85% of their production overseas. GDS have achieved this through a combination of continuous product development, understanding customer’s requirements and a company wide dedication to customer support.

**Made in the UK:**

All GDS products are designed, manufactured and assembled in the UK at our offices in Hook. Quality assurance is taken of all products before they are dispatched.

GDS are an ISO9001:2000 accredited company. The scope of this certificate applies to the approved quality administration systems relating to the “Manufacture of Laboratory and Field Testing Equipment”.

Due to continued development, specifications may change without notice. See the GDS website for the full product range & to visit our Geotechnical Learning Zone.