Enterprise Level Dynamic Triaxial Testing System (ELDYN)

Overview: The GDS Enterprise Level Dynamic Triaxial Testing System (ELDYN) is a triaxial system, based on an axially-stiff load frame with a beam mounted electro-mechanical actuator. The ELDYN has been designed to fulfil the demand within the geotechnical laboratory testing industry for a lower cost, more basic dynamic triaxial testing system, yet still performs to the very advanced standards that customers expect from GDS.

For standards see website.

Key Features:

Benefits to the User:

Electro-mechanical system:	The ELDYN system supersedes systems using pneumatic actuators in terms of life costs and overall usable performance. Electro-mechanical systems can carry out full load dynamic testing to the stated frequency. Pneumatic systems tend to reduce the available amplitude with load due to the amount of air that needs to be moved from one side of the actuator to the other.
Cost savings, environmental benefits and safer operation:	Electro-mechanical systems are more environmentally friendly as they only draw the energy required to do the test, resulting in lower life costs. Electro-mechanical systems are also safer to run due to no high pressure air or hydraulic pipelines being required. No large noisy power packs are required to be running all the time, the ELDYN only requires a standard mains electricity outlet, this reduces the laboratory space required and the installation costs.

Tests that can be Performed:

Static and dynamic triaxial - consolidation undrained (CU), consolidation drained (CD), cyclic testing of samples under both strain and load control, slow cyclic testing, quasi-static (low speed/creep) tests, stress paths and user defined waveforms.

Upgrade Options:

Optional upgrade to user defined waveforms, upgrades from 5kN to 10kN, Bender element system (Vertical, Horizontal, S and P waves), hall effect local strain, LVDT local strain and unsaturated testing. Optional upgrade to Resilient Modulus with the addition of the RM software module only (specific range transducers may have to be purchased, depending on the RM standard). Note: the ELDYN by default is supplied with the capability of performing RM waveshapes for AASHTO, AS and AG standards.

Technical Specification:

Actuators:	Highly accurate dynamic electro-mechanical actuator
Axial Displacement Encoder:	Yes
Axial Load:	+/- 5 kN at 5Hz (upgradeable to +/-10kN)
Computer Interface:	USB
Closed Loop Control Frequency:	16kHz
Data Acquisition:	16 Bit
Load Range (kN):	5 (optional 10)
Operating Frequency (Hz):	5 (optional 10)
Pressure Range (MPa):	1 standard (Up to 2)
Sample Sizes (mm):	Depends on cell chosen (38 to 150 standard)

Systems Elements & Options

The fundamental system hardware elements are shown in Fig. 1 below.

4 Channel Dynamic Control System (ELDCS)

The ELDCS, Enterprise Level Dynamic Control System, provides a 4-channel dynamic data logger with 16 bit data acquisition for the Internal Submersible Load Cell and Pore Pressure Transducer provided. An optional displacement transducer can be fitted and logged on one of the spare channels, although this is not entirely necessary due to the encoder on the axial actuator.

Further ELDCS boxes may be added using the synchronized data bus connection, therefore further dynamic acquisition channels can be added in multiples of 4.

GDSLAB Software

The GDSLAB control and acquisition software is a highly developed, yet extremely flexible software platform. Starting with the Kernel module and the ability to perform data acquisition, additional modules are added for your testing requirements.

Pore Pressure (kPa)
Cell Pressure (kPa)
Load Cell (kN)
SPARE

Note: Connection via USB or RS232 depending on system chosen.

Load frame control

Back pressure / volume

Cell pressure

Pressure Volume / Controllers

The back pressure is controlled by a enterprise level controller and the cell pressure is controlled by a pneumatic controller.

• The GDS Enterprise Level Pressure/Volume Controller (ELDPC) is a general-purpose water pressure source and volume change gauge for the precise regulation and measurement of fluid pressure and volume change.

• The GDS pneumatic controller is an economical source of computer controlled regulated air pressure control. The controller regulates an external pressure source such as a compressor or compressed air cylinder to provide a controlled output pressure.

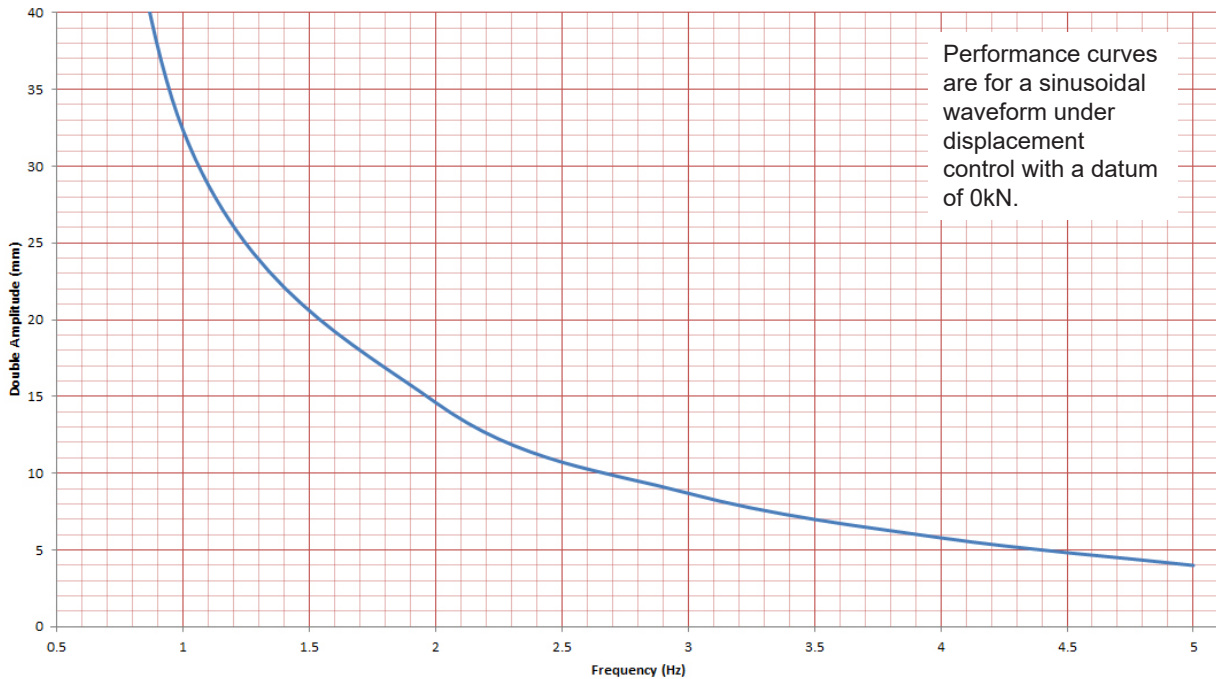### Frequency Range (Hz)

• 5 & 10.

Load Range (kN)

• 5 & 10

Specimen Sizes (mm)

• 38, 50, 70, 100, 150,

Typical System Behaviour Showing Frequency & Amplitude for 5Hz / 10kN

Performance curves are for a sinusoidal waveform under displacement control with a datum of 0kN.

Upgrade Options:

LVDT local strain and unsaturated testing, hall effects local strain & bender element system (Vertical, Horizontal, S and P waves).

Upgrade to Local Strain Measurement

Any ELDYN system may be upgraded to perform Local Strain measurement using either Hall Effect or LVDT transducers. Both device types enable axial and radial deformation to be measured directly on the test specimen via lightweight aluminium holders. Hall Effect transducers may be used in water up to 1700kPa.

LVDT transducers come in 2 versions:

•   Low pressure (up to 3500 kPa) version for use in water.
•   High pressure (up to 200 MPa) version for use in nonconducting oil.

Fig 2. LVDT transducers as shown on sample.

Upgrade to Unsaturated Testing

Any EYDYN system may be upgraded to perform unsaturated triaxial testing with the addition of the following items:

•   Unsaturated pedestal with high air entry porous stone.
•   1000cc digital air Pressure/volume controller (ADVDPC) for the application of pore air pressure and measurement of air volume change (see Fig. 3).
•   Optional HKUST double cell (for more information on this please see the data sheet 'Unsaturated Triaxial Testing of Soil (UNSAT).
•   Optional double walled cell.

Fig 3. Advanced Pressure Controller used in Unsaturated Testing

For further information on unsaturated testing methods, please refer to the unsaturated datasheet.

Temperature Controlled Testing

The temperature controlled ELDYN is attached to a steel work bench. The work bench has a sliding rail and a mounted lifting frame for easy cell removal. The work bench also contain all pressure / volume controllers and data loggers for the apparatus, therefore reducing the space required in the laboratory.

- Heating and cooling options for the ELDYN:

    - -20°C to +65°C
    - -30°C to +85°C
    - -30°C to +100°C

- Heating only is from ambient to +100°C

- Sample size up to 150mm
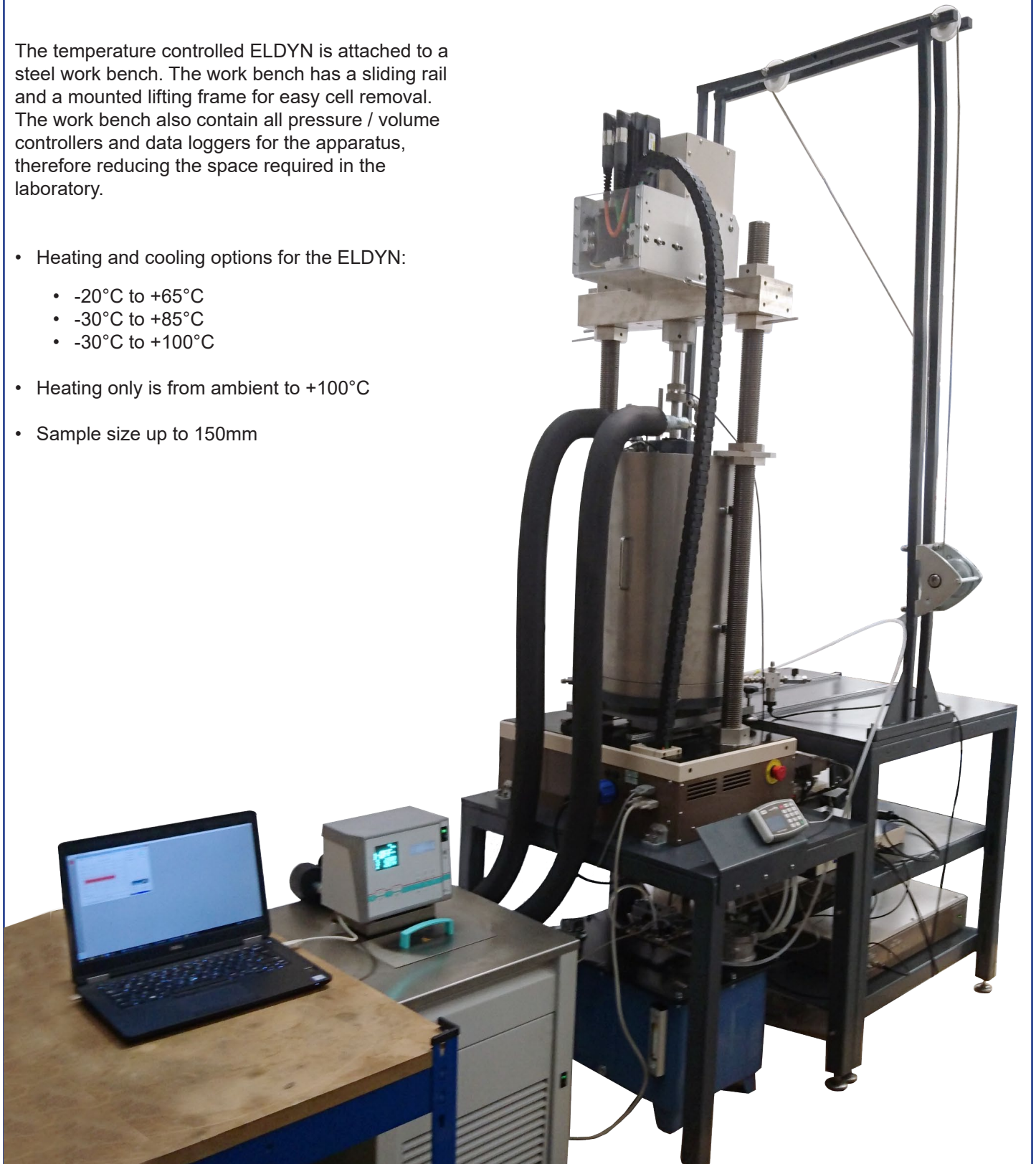
Upgrade to Bender Element Testing

Any GDSTAS system may 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.
- High-speed data acquisition card.
- 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:

The subjectivity and lack of satisfactory standards for interpreting shear wave travel times across the industry from bender element test data, has led GDS to develop a bender elements analysis tool. The tool allows the rapid, automated analysis of bender element tests to objectively estimate the shear wave travel time. The analysis tool is available to download from GDS' website.
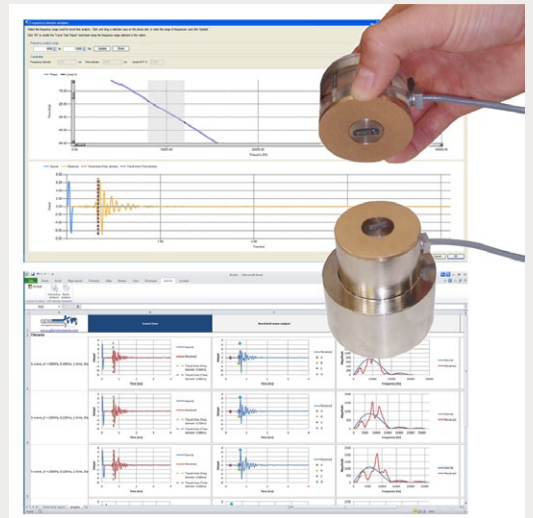
Fig. 4 Shows screenshots of the GDSBEAT software.

GDSLAB Control Software

GDSLAB is the control and data acquisition software for geotechnical laboratory applications. 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. GDSLAB is compatible with all existing GDS equipment and furthermore key hardware from other manufacturers.

GDSLAB has the ability to be configured to your hardware of choice, no matter how unique the arrangement. A text file (*.ini) or initialisation file is created that describes the hardware connectivity to the PC. The hardware layout is available in graphical format via the GDSLAB 'object display'. This makes setting up the devices and checking the connectivity extremely simple.
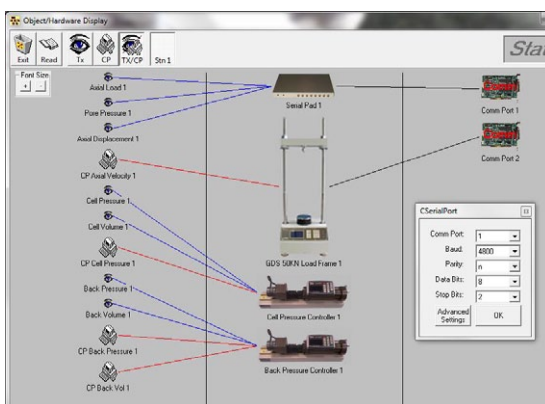

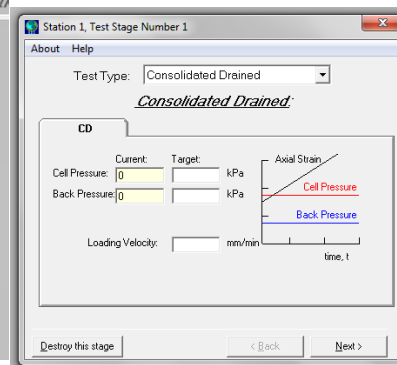Fig. 5 Show a typical set-up screen in GDSLAB

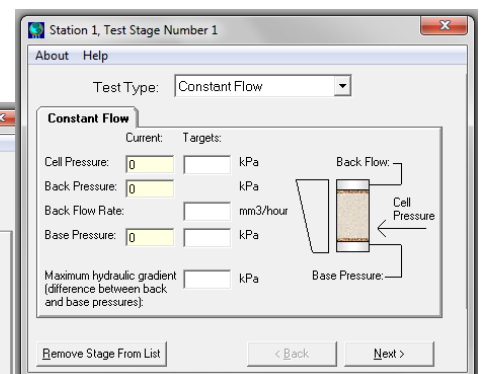Fig. 6 Show a typical station test stage set-up in GDSLAB

Fig. 7 Show a typical station test stage set-up in GDSLAB

Required Operating System: Windows 7 SP1 or higher (We strongly recommend that Windows is fully up to date and running the latest Service Pack/ Version available). Recommended PC Specification: 2GHz processor, 4GB Ram, 64Bit Operating System and USB connectivity. Note: GDS software can run on lower spec PC's however; performance and processing of data may be affected.

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Why Buy GDS?

GDS have supplied equipment to over 84% of the world's top 50 Universities:

GDS have supplied equipment to over 84% of the world's top 50 Universities who specialise in Civil & Structural Engineering, according to the "QS World University Ranking 2019" report.

GDS also work with many commercial laboratories including BGC Canada, Fugro, GEO, Geolabs, Geoteko, Golder Associates, Inpijn Blokpoel, Klonn 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.

EXCELLENT
VERY GOOD
GOOD
AVERAGE
POOR

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.

2 YEAR EXTENDED WARRANTY **1 YEAR EXTENDED WARRANTY** **3 YEAR EXTENDED WARRANTY**

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.