

## Hydraulic Loadframes for Soil & Rock (HLF)

**Overview:** The GDS Hydraulic Loading Frames (HLF) are load frames with a hydraulic dynamic actuator mounted on the cross beam for axial loading. With range of 100kN, 250kN and 1500kN.

The system is capable of dynamic cyclic axial displacement or axial force and can be synchronised with an optional dynamic cell pressure actuator (radial stress), to give an advanced capability of dynamic stress path testing.

Using large diameter triaxial cells, the HLF enables tests to be performed on large particle sizes such as ballast.



### Key Features:

The GDS Hydraulic Axial/Radial Loading Frame can be synchronised with the cell pressure (radial stress):

Advanced transducers available:

GDS load frames are extremely stiff and are designed to allow minimum backlash at the point of sample shearing:

The system is capable of both monotonic (static) and dynamic triaxial tests:

Dynamic control of axial displacement or axial force up to 20Hz (frame dependant), sinusoidal waveform:

Optional dynamic control of radial stress up to 20Hz, sinusoidal waveform:

Optional interchangeable load cells:

### Benefits to the User:

To give a wider range of testing options for the user, the system can provide stable radial stress during testing, removing the requirement for a balanced ram system, with the ability to add an additional dynamic pressure controller to cycle the back/pore pressure during testing.

A number of optional advanced transducers can be added to the standard system to give measurement of local axial strain and mid-plane pore pressures. Cells can also be updated to incorporate acoustic velocity and acoustic emission transducers.

Other, less stiff load frames can have adverse effects on the results at the point of specimen failure. At this critical point in the test, due to the compliance in the system under high load, the resulting backlash that is released after failure can affect the results of the test. GDS has overcome this by ensuring the frames are designed to be stiff and ridged at their maximum loads.

As well as other advanced triaxial tests usually expected from a GDS system, the system is able to perform static testing, allowing for a single system to perform a wider range of tests.

Direct (dynamic, up to 20Hz frame dependant) closed loop control of axial displacement, axial force and cell pressure.

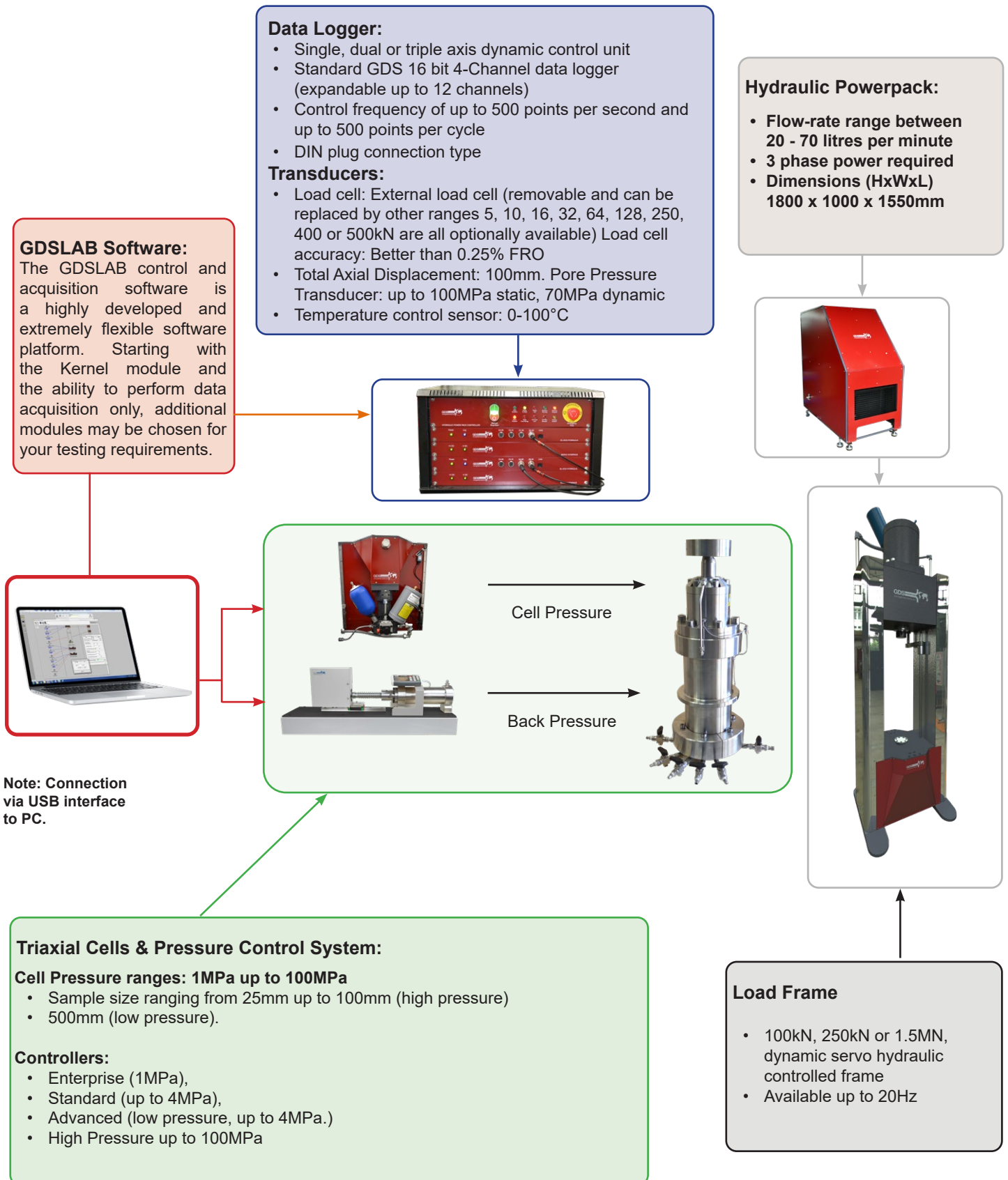
The dynamic control of cell pressure means that for those tests where the cell pressure is constant but the axial actuator is moving dynamically, the cell pressure actuator automatically adjusts the volume of oil in the cell to maintain a constant cell pressure, or it can be used to cycle the cell pressure.

The load frame is supplied with an external load cell to match the model maximum load range as standard. However, to accommodate soft to very stiff soil ranges of 28, 100 and 250kN are also available.

### Technical Specification:

<b>Computer Interface:</b>	USB
<b>Frequency:</b>	100kN & 250kN - up to 20Hz, 1.5MN - 5Hz
<b>Load Range (kN):</b>	100kN, 250kN, 1.5MN
<b>Weight Approx (kg):</b>	100kN - 670kg, 250kN - 1280kg, 1.5MN - 7000kg

## A Typical Specification Using a Dynamic Servo-hydraulic Load frame:



## Temperature Controlled Testing

GDS have a large range of temperature controlled rock testing systems. Our temperature systems offer two variables; heating & cooling or heating only. Combined heating and cooling systems use coiled tube sections inside the cell; this is connected through the standard ports within the cell base to a temperature control unit allowing temperature transfer close to the specimen.

The cooling system provides ideal conditions for frozen soil testing. Its high pressure testing capability (up to 100MPa) along with low temperature provides the ideal environment for Gas Hydrate Testing. The heating only systems have options from ambient up to either 60°C, 100°C or 150°C.

### Heating Only Options:

- Ambient to 60°C
- Ambient to 100°C
- Ambient to 150°C

### Pressure Options:

- 4, 10, 14, 20, 32, 64, 70 or 100MPa

### Product Applications:-

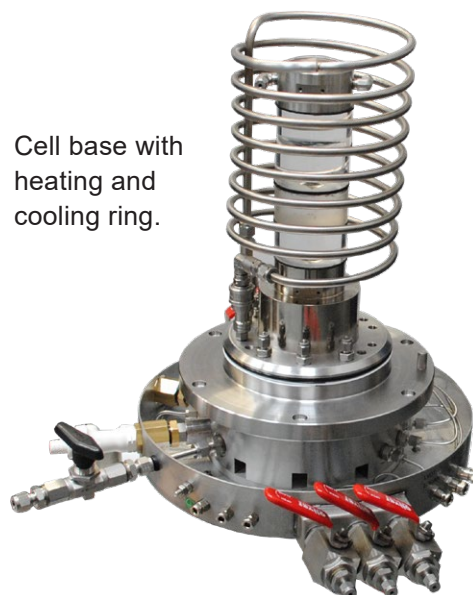
- Frozen Soil Testing
- Gas Hydrate Testing
- High Pressure Testing
- High & Low Temperature Testing

### Heating & Cooling Options:

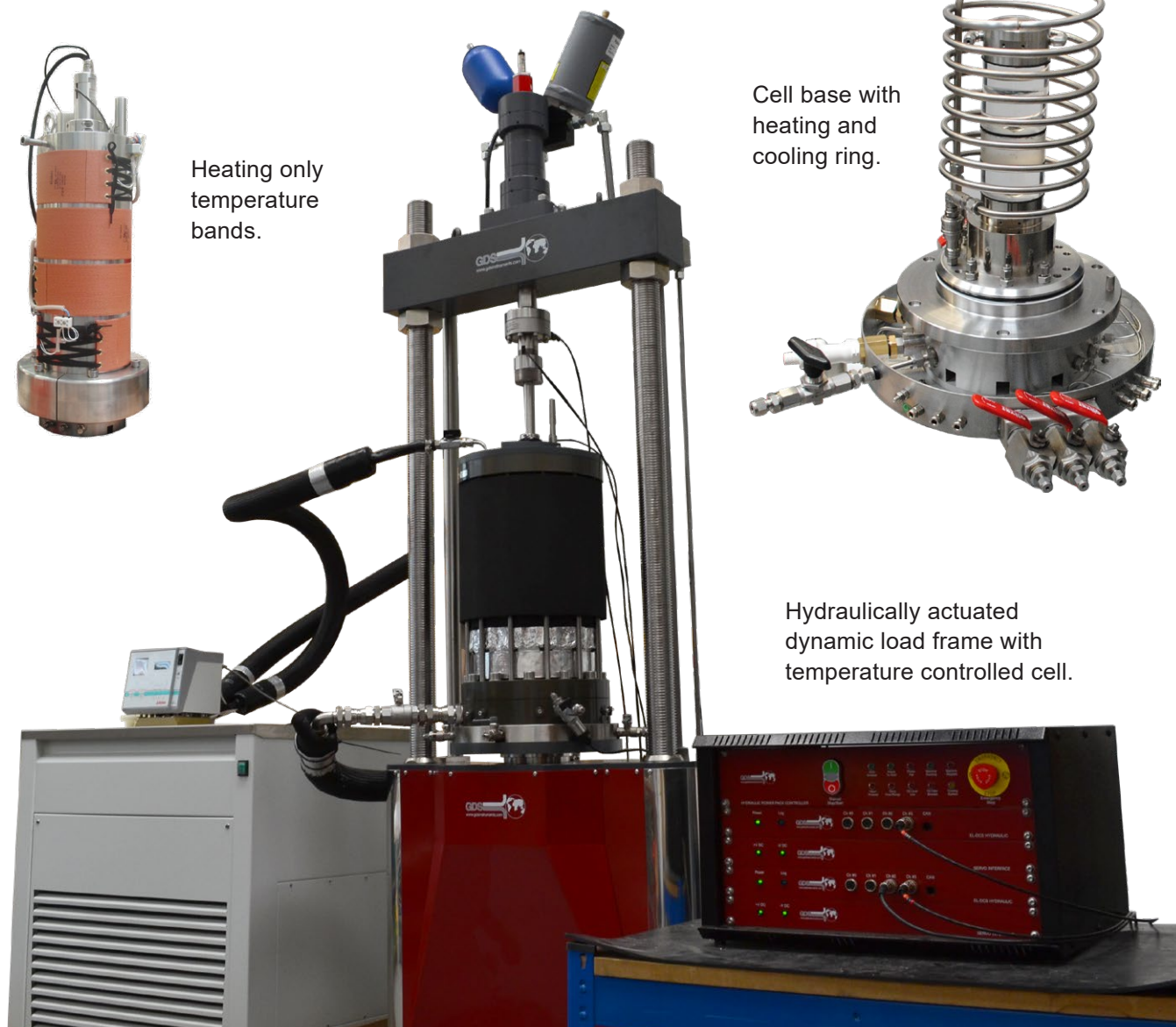
- -30°C to +85°C
- -20°C to +85°C
- -10°C to +60°C



Heating only temperature bands.



Cell base with heating and cooling ring.



Hydraulically actuated dynamic load frame with temperature controlled cell.

## Load Frame Options:



250kN Loadframe

## Load Frames and Dimensions

	100kN	250kN	1.5MN
Height (mm):	2500	3220	3340
Width (mm):	790	984	1060
Depth (mm):	902	902	1000
Daylight clearance for test cell:			
Max width (mm):	500	600	600
Max height (mm):	900	1150	1250
Weight (kg):	670	1280	7000

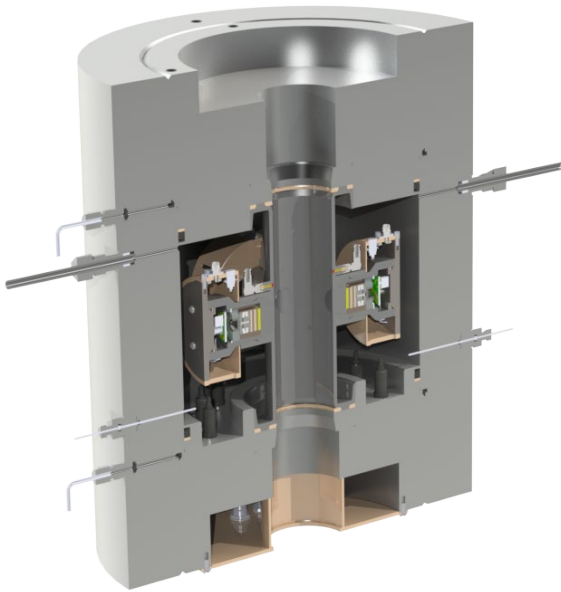
## Triaxial Cells

Cells Available:	Pressure (MPa):	Max Specimen Size (mm): Dia - Hei	Balanced Ram:
High Pressure Cells:	4	100 - 200	N
	10	150 - 300	N
	14	100 - 200	N
	20	100 - 200	N
	32	54 - 108	N
	64	100 - 200	Y
	70	70 - 140	N
	100	50 - 100	N
Instrumented Hoek Cell:	70	50.8 - 101.6	N
Large Diameter	1	≤ 300	N

## Pressure Volume / Controller

Controllers Available:	Pressure (MPa):
Advanced Pressure Volume Controller:	up to 4
High Pressure Advanced Volume Controllers:	8, 16, 32, 64, 100
Cell and Back Pressure Intensifier:	4MPa / 1000cc





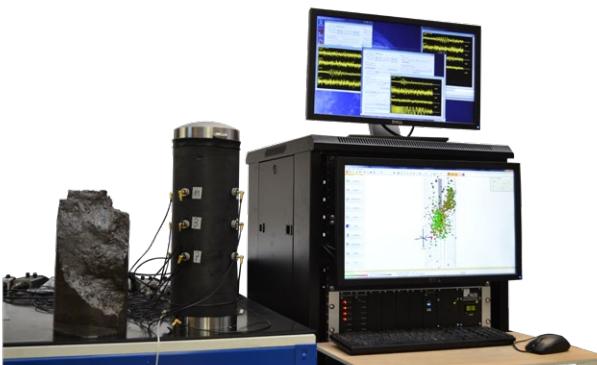
### Instrumented Hoek Cell (Optional):

The GDS Instrumented Hoek Cell brings together the traditional high pressure Hoek Cell, with the functionality of advanced testing capabilities for Acoustic Emission (AE) and Acoustic Velocity (AV) testing. Below are some features and benefits of the cell.

- Max pressure: 70MPa.
- Upgrades available: Acoustic Emission & Acoustic Velocity (both horizontal (up to two sets) and vertical).
- Sizes available: 38.1mm and 50.8mm diameter.
- Special membranes allow for the AE and AV transducers to quick connect via push fit connections.
- AV transducers are mounted in the topcap and pedestal.
- Up to 12 AE transducers, 1 set of vertical AV transducer, up to 2 sets of horizontal AV transducers can be installed in each cell.
- Access to the inner chamber and membrane is done with a screw threaded top section and a specially designed top plate that allows the entire internals of the cell to be removed for easy maintenance.

### Acoustic Emission Transducers (Optional):

The AE transducers enable micro-fractures occurring within a rock specimen during testing to be recorded and analysed. Analysis of rock micro fractures can give information as to the failure mechanisms of a sample under test as well as determining the onset of failure.



The AE system may be specified as a triggered type system or a continuous acquisition system. The triggered 'hit counter' system yields less but more simple data to process, whereas, the continuous system never misses a beat. The system can be configured to use both triggered and continuous data acquisition.

### Acoustic Velocity Transducers (Optional):

Systems to measure the P- and S- Wave velocity within a sample. AV sensors are generally used where pressures and load exceed those where bender elements can be used. AV sensors are based on the same principle as bender elements but the piezo ceramic elements are not exposed to the environment so they can be used at pressures up to 100MPa and an axial force up to 2MN. Sensors are mounted in the pedestal and topcap or to the sides of the sample in some cases. Each sensor package contains a Compressional wave (P-Wave) element and two shear wave (S-Wave) elements.

The Shear wave elements are set in orthogonal directions to allow two shear waves to be generated with different polarisation, which, is important where samples may be cross-anisotropic or fully anisotropic.



## 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.

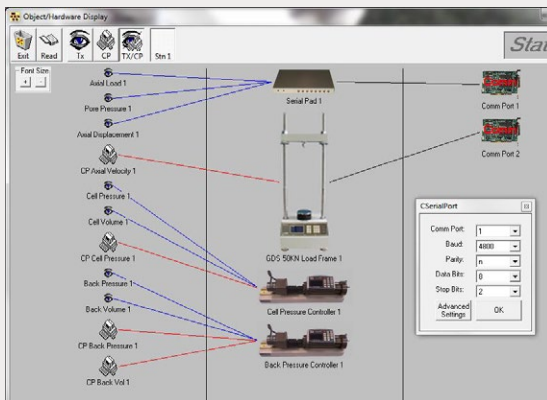


Fig 4. Show a typical set-up screen in GDSLAB

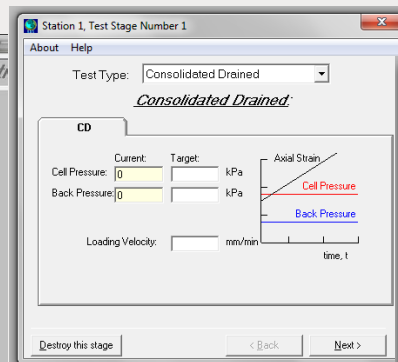


Fig 5. Show a typical station test stage set-up in GDSLAB

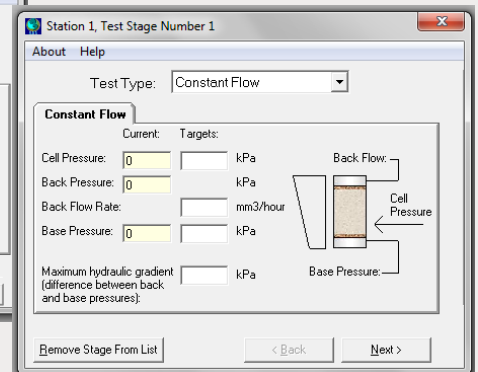


Fig 6. Show a typical station test stage set-up in GDSLAB

*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.*

## GDSLAB REPORTS Presentation Software

GDSLAB REPORTS software presents data obtained by GDSLAB to the National Standard, BS 1377:1990. The program can be used to present data whether obtained from a GDSLAB data file or inputted by hand.

GDSLAB Reports can as be used with other manufacturer's dataloggers as well as all versions of GDS data logger. The results can be exported as a CSV file into Microsoft Excel, allowing the user to customise the layout of results.

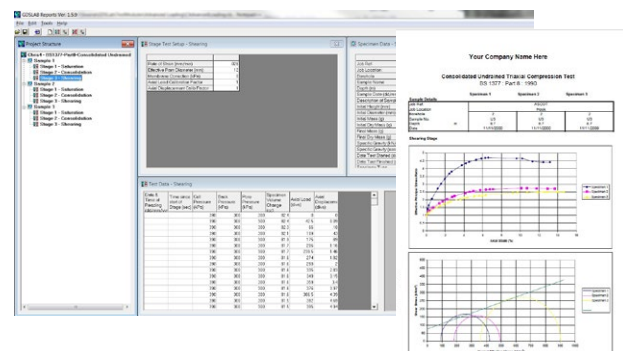


Fig 7. show a selection of screenshots from the GDLAB Reports software.