2021/421

Charles University, Faculty of Science
With its registered seat at: Albertov 6, 128 00 Praha 2
Registration No.: 00216208, VAT No.: CZ00216208
Represented by: prof. RNDr. Jiří Zima, CSc., dean of the faculty
IBAN: CZ25 0100 0349 5609 2145 7021
hereinafter referred to as the "buyer"

VZ/21/546

SELLER	Global Digital Systems Ltd		
Represented by		Position	Sales Director
Registered seat at	52c Borough High Street, London, SE1 1XN, U.K.	Reg. No.	1459108
Mailing address	28-32 Murrell Green Business Park, London Road, Hook, Hampshire, RG27 9GR	VAT No.	GB 355 5934 41
Registered in	UK	Account number	10011466

hereinafter referred to as the "seller"

THE PURCHASE AGREEMENT

Seller's contract number ..... Buyer's contract number[1] .....

A. SPECIAL PART

Description of goods	New and unused **One dimensional loading CRS apparatus** Further definition of the goods specified in the Annex 1 and 2.		
Subject of the contract	**by the seller** Transfer of ownership of the goods to the buyer Delivery to the place of delivery Demonstration of the functionality of goods Installation	Providing necessary training with acquired goods Handover of documents Warranty Service	
	by the buyer Receipt of the goods at the point of delivery Payment of the purchase price		
Delivery date	**Not later than 30 weeks from the efficiency of the contract**	**Place of delivery**	**room S20, Albertov 6, Prague 2, Czech Republic**
Purchase price without VAT	**£51,766**		
Payment of invoices	20 days after receipt of the invoice by the Buyer	**Basic terms of payment**	- Advance is provided - Invoice must by delivered to the Buyer immediately after the effective date of the contract - Number of this contract must be on the invoice
The warranty period	**12 months**	**removal of defects warranty**	Service at the latest in 72 hours and other defects within 30 working days from notification
Place of removal of defects	Global Digital System Ltd	**Contact for notification of warranty defects**	
Post-warranty service including: - elimination of post-warranty defects within 60 working days of notification for the usual price at the place and time - availability of spare parts for the device and their delivery within 10 weeks of ordering for the usual price at the place and time			Post-warranty service is provided for a period of 60 months from the end of the warranty period
The seller hereby declares that at the time of concluding this contract, the following administrative proceedings are being conducted against him for breach of the obligations arising from labour law regulations and / or the anti-discrimination law / regulations[2].			NO PROCEEDINGS CONDUCTED
Terms of sanctions	- For delay with payment of financial performance interest on late payment 0.1 % of the owed amount (incl. VAT) for each day of delay. - For delay in delivery of goods a penalty of 0.1% of the purchase price (incl. VAT) for each day of delay. - For delay in removing reported warranty defects 0.3% of the purchase price (incl. VAT) for each failure to cure the defect and for each day delay. - For non-delivery of goods with parameters specified in Annex No. 1 and / or 2 in the amount of 15% of the purchase price (incl. VAT). - For delay in remedying the defect stated in the handover protocol CZK 3000 for each day of delay and each defect. - Should the statement concerning administrative proceedings for breach of obligations arising from labour law regulations and / or from the anti-discrimination law / regulations proven false, for each individual case in the amount of CZK 5000.		
Annexes	Annex No. 1: Absolute requirements (Annexe 3 of the Invitation to tender) Annex No. 2: Goods parameters specification (specification of the offered subject, e.g. leaflet)		

[1] To be added manually by the buyer before signing the contract. In case of electronic signature of the contract, the buyer shall state the contract number in the name of the contract.
[2] Especially the Charter of Fundamental Rights of the European Union and/or European Convention on Human Rights

Contact person of the seller	Note: contact details will not be published in the register of contracts pursuant to Act No. 340 / 2015 Coll.
Contact person of the buyer	

B. GENERAL PART

This part regulates detailed conditions of the purchase contract. The Part A defines basic conditions of this contract. In the event of any conflict between the Part A and the Part B of this contract, the Part A has precedence.

I. Introductory provisions

1) The seller must deliver the new and unused goods and provide services associated with the delivered goods. If the contract is concluded on the basis of a selection or an award procedure the goods must have product properties and parameters required by the buyer in the tender conditions. Goods must fulfil the stated purpose. If the purpose is not expressly stated, it must fulfil the purpose which is determined by the way the goods are generally used.
2) The goods delivered contrary to the paragraph 1 of this Article shall be deemed defective.

II. Invoicing and payment terms

1) The purchase price includes all costs and profit of the seller. The purchase price includes, in particular banking and other fees, transport and installation of the goods, putting into a permanent operation, removal of packing material, an operator training and the buyer's costs for warranty service. The purchase price is fixed and complete and includes complete delivery.
2) The invoice must be in accordance with the generally binding legal regulations and according to the part A of this contract. Should the invoice contain incorrect information or be incomplete, the buyer is entitled to return it to the seller for a revision or an amendment. In such case, a new maturity period runs from the date of delivery of the corrected invoice to the buyer.

III. Terms of delivery and transfer of title

1) The seller delivers the goods with proper accessories. Accessories especially comprise of the installation material, assembly jigs, connectors, jumper cables, user codes, passwords, etc.
2) A protocol about delivery and acceptance of the goods (hereinafter the "*acceptance protocol*") shall be drawn up and signed after the delivery and acceptance of the goods. The acceptance Protocol must include, among other things, information about the frequency and method of revisions. If there is a seller's responsibility to install the product, there shall be drawn up and signed an installation protocol by both parties about the installation of goods, commissioning and testing.
3) The buyer is obliged to accept the goods only if it is free of defects. The buyer is entitled to refuse defective goods. Should the buyer accept the goods with defects, the acceptance protocol shall state the defects and set a deadline for their removal. By taking over the goods with defects, the buyer loses the right to a contractual penalty for delay in delivery of the goods. The guarantee shall begin to run only after the removal of all defects of the goods and the signature of the final handover protocol.
4) The seller agrees to deliver to the buyer the documents necessary for the proper use of the goods, for example appropriate approval certificates, declarations of conformity, instructions for usage and operation, assembly and installation instructions.
5) Risk of damage to the goods passes to the buyer upon signing the installation protocol. If there is not an obligation of the seller to install the goods, risk of damage passes to the buyer upon signing the acceptance protocol.
6) If the seller is required to install the product, the installation shall be completed immediately after the delivery of goods and without undue delay. The seller is obliged to perform the installation with professional care and warn the buyer about risks associated with the placement of goods. The seller is obliged to refuse an installation of the goods if the conditions specified by the manufacturer or by generally binding legal regulations for its implementation are not met. At the request of the seller, the buyer will sign the installation protocol after the installation. Such protocol is not a proof of receipt of the goods.
7) If the seller is obliged to train operators, he must do so upon delivery, unless the parties agreed otherwise. The buyer is obliged to provide the seller with the necessary cooperation, in particular to determine the persons who shall participate in the training and ensure their participation in the training.
8) The contact persons specified in Part A of this Agreement are authorized to sign the installation and handover protocol. Contact person of the buyer is entitled to claim from defects of goods. If there are more contact persons, they are entitled to act individually.
9) The buyer is entitled to take over the partial performance. Upon receipt of the partial performance, a deadline will be set for the delivery of the remaining performance. Such period may not exceed 30 days.

IV. Guarantee of quality (warranty)

1) The seller provides the buyer a guarantee of quality (warranty) for the period specified in the Part A of this contract. The guarantee (warranty) begins upon the signing of acceptance protocol.
2) The seller guarantees that the product will have the usual characteristics or properties stated by the contract during the guarantee period.
3) Warranty service is provided free of charge by the seller and includes all costs associated with the warranty service, especially the costs of spare parts, travel and labour services of a technician.
4) The buyer announces warranty defects to the contact for notification of warranty defects or seller's Authorized person referred to in the Part A of this contract. Seller shall start examining and working on the removal of the claimed defects after the receipt of the notice of defects without undue delay. If the seller will not be able to remove the defects within the period of time provided for removal of warranty defects set out in the Part A of this contract, the seller will provide and deliver an adequate replacement device or devices that functionally replace the defective goods, until the defective goods are repaired and put into operation.
5) If the warranty defects are removed by the seller according to the Part A of this contract, the buyer sends notice along with the goods.
6) The warranty period does not run as long as the buyer cannot use the goods for its defects, for which the seller is accountable.

7) The warranty does not cover damage to the goods caused by an improper or incorrect installation or an incorrect operation contrary to the instructions given in the operating instructions, or an inadequate storage contrary to its technical characteristics.
8) The buyer is entitled to withdraw from the contract if he cannot deliver the notice of defects to the seller.
9) If the seller is in default with the removal of warranty defects, the buyer has the right to withdraw from the contract after providing an additional reasonable time for removal of defects.
10) In the event that the warranty defect is not repairable, the buyer is entitled to withdraw from the contract or to request the delivery of new goods.
11) In the case of an unjustified notice of defects the buyer pays the costs of removing defects.
12) The buyer has the right for the removal of defects even if the defects were knowable during the contract closure.
13) During the warranty period, the seller undertakes to carry out regular service inspections (safety checks) prescribed by the manufacturer and applicable legal regulations, including software updates, initial and subsequent validation or calibration of parameters, servicing necessary for warranty validity. Such acts shall be performed by the seller without the buyer's request, including the delivery of the necessary material and spare parts, without any claim for further payment beyond the agreed purchase price.
14) The warranty period does not run for the period when the warranty defect is being removed, starting with the notification of the warranty defect and ending with the return of the repaired goods to the buyer. If new goods are handed over to the buyer instead of repairs, the warranty period for these new goods continues. The continuing warranty shall run for at least half of the warranty period agreed upon in this contract.

V. Responsible public procurement

1) The seller hereby declares that they are aware of the fact that the buyer is interested in realization of the public contract in accordance with the principles of socially responsible public procurement. The principles of environmentally responsible procurement and innovation are elaborated both in the wording of the entire tender documentation and in this contract. This article regulates socially responsible public procurement.
2) The seller is obliged to notify the buyer that a public authority (especially the State Labour Inspection Authority or regional inspectorates, the Regional Hygiene Station, etc. or another similar body abroad) has initiated proceedings against him for breach of labour law and / or anti-discrimination law /regulations throughout the duration of this contractual relationship, no later than 10 days from the delivery of the notice of initiation. Notice of the seller shall also include information on the date of the delivery of the notice of commencement of proceedings.
3) The seller is obliged to hand over to the buyer a copy of the final decision on terminating the proceedings pursuant to the previous paragraph of this Article, no later than 7 days from the date on which the decision takes legal effect. Simultaneously with a copy of the final decision, the Seller shall provide the Buyer with information on the date of entry into force of the decision.
4) Should the seller be convicted of a misdemeanour, administrative offense or other similar infringement within the proceedings pursuant to this Article, the seller is obliged to take adequate corrective measures and inform the buyer in writing about such measures, including methods of their implementation.
5) For the duration of this contractual relationship, the buyer is entitled to ask the administrative authorities competent to control the compliance with labour law and / or the anti-discrimination regulations whether administrative proceedings are being conducted with the seller regarding breaches of labour law and / or anti-discrimination law / regulations and to ask for all information concerning such proceedings.
6) Breach of the obligation specified in this article is considered to be a breach of contract with all the resulting consequences.

VI. Final provisions

1) Contract's penalties are set out in the Part A of this contract. Contracting party is not obliged to pay a contractual penalty if the breach of duty assigned to it by this contract was caused by force majeure.
2) Should the goods or its part meet the criteria of a copyrighted work, the seller transfer to the buyer even the non-exclusive license to all types of usage of such work without the restrictions of time or spatial constraints. The buyer is not obliged to use the work. The price of the license is included in the purchase price.
3) Individuals who enter into this contract on behalf of each party signature the contract claim that they are entitled to make a valid contract.
4) The seller is not entitled without the prior written consent of the buyer to assign any rights or duties arising from this contract to a third party.
5) This contractual relationship should be governed by these documents with descending importance:
    a) This contract;
    b) Annexes to this contract;
    c) Tender documentation;
    d) Offer of the seller;
    e) General terms and conditions of the seller.
6) The seller hereby undertakes the risk of a change in circumstances within the meaning of Section 1765 (2) of the Act No. 89/2012 Coll., the Civil Code.
7) This contract can only be modified by numbered amendments in writing signed by both parties. Such changes shall be made pursuant to Section 222 of the Act No. 134/2016 Coll., Public Procurement Act.
8) The buyer excludes the possibility of accepting the draft contract with amendments or deviations in the sense of Section 1740 (3) of the Civil Code.
9) The seller acknowledges that the buyer is obliged to publish all contracts including its annexes and any amendments if the price of performance is greater than 50 000 CZK without VAT. The seller agrees that the buyer discloses the contract pursuant to the

Act No. 340/2015 Coll. or/and also according to the Act No. 134/2016 Coll. as a whole, because there is no information in the contract which disclosure would be an unlawful interference with the rights and obligations of the seller or its employees. The seller agrees that the contract will be disclosed, including manual signatures of representatives of the parties.

10) This Contract shall enter into force upon a signature by both parties. This contract shall enter into effect upon publication of the contract pursuant to the Act No. 340/2015 Coll.

11) The contracting Parties agree that the rights and obligations of this agreement shall be governed by the Civil Code of the Czech Republic. The contracting parties agree that the rights and obligations not regulated by this contract are governed by the Public Procurement Act and the Civil Code.

12) The contracting Authority assumes that this contract will be signed electronically. Should this contract be signed in paper form, it shall be written in two counterparts. Each of the contracting Parties shall receive one counterpart.

13) The contracting Parties declare that they have read this Agreement, and that it was made after mutual negotiation using their free, serious, determinate and comprehensible will, not in distress or grossly disadvantageous conditions.

In Prague on 24.9.2021

Buyer:

Charles University, Faculty of Science
prof. RNDr. Jiří Zima, CSc.
Dean of the faculty

UNIVERZITA KARLOVA
PŘÍRODOVĚDECKÁ FAKULTA
Albertov 6, 128 43 Praha 2
IČO: 00216208, DIČ: CZ00216208
UK – 104

In Hook, Hampshire, UK on 23/08/21

Seller:

Global Digital System Ltd

Sales Director

GLOBAL DIGITAL SYSTEMS LIMITED Company No. 01459108

Procurement - **One dimensional loading CRS apparatus**			
	Required minimum parameters:	**The participant meets YES / NO**	**Product specification[1]**
1.	Loading frame (maximum capacity 50-70 kN) with constant rate of strain control and possibility of stress control	Yes	**DWG-LF50KNGA0002-P** 50kN electro-mechanical, two column digital loading frame. - Keypad and LCD display for stand-alone operation - Velocity control - Displacement control - Optional closed loop displacement/load control. - Speed range 0.00001mm to 89.99999 mm per minute. - Accepts traixial cells up to 150mm sample diameter. - Maximum load: 50kN - Maximum travel: 100mm - Platen diameter: 158mm - Horizontal daylight 380mm - Vertical daylight 800mm - USB port for PC control - 380mm (Depth) x 480mm (Width) x 1400mm (Height) Note: Alternative load frames of up to 2000kN are also available. Accepts cell up to 375mm diameter
2.	Testing cell capable of applying back pressure and measuring pore pressure up to at least 3 MPa. The cell must be designed for samples of diameter in a range 50-64 mm and height of 20-25 mm	Yes	**DWG-CRSCELSA0237-P** CRS Cell to fit into 50kN Load Frame or Automated Oedometer System with GDS CRS upgrade. Maximum Pressure: 3MPa with Aluminium cell wall Recommended for use with Internal Submersible Load cell. Sample size 38 to 100mm (sample sets purchased separately) Note: Compatible with CRSCEL series sample sets, incompatible with CRS3MP series sample sets.
3.	Sample set, which include base plate with pressure connections, confining and	Yes	**DWG-CRSCELGA0014** Sample set for CRS Cell, 63.5mm x 22mm high, includes:

[1] The participant will specify the parameter specification in a separate chapter of its offer by the official technical and visual documentation of the goods, e.g. leaflet.

	cutting rings, top and base drainage disks and top cap		- Base plate with 2 x pressure connections - Sample confining ring - Cutting ring - Top cap with top and base drainage disks. - Alternative sizes available: 50, 66, 70, 75 or 100mm. - Custom sizes on request.
4.	Pressure and volume controller with minimum upper pressure limit 3 MPa and minimum volume of 200cc	Yes	**STDCON0003-P** V2 New Style 200cc/3MPa STANDARD Pressure/Volume Controller: - Remote keypad included - Automatically protected against pressure and volume over-ranges. - Volume accuracy 0.25% of measured value. - Pressure accuracy 0.15% of Full Range. - Volume change measured and displayed to1cu.mm (0.001cc). - Pressure regulated and displayed to 1 kPa. - USB interface. - Includes USB and power cable.
5.	Internal load cell (maximum limit 5-20 kN), pore pressure transducer (maximum pressure at least 3 MPa) and linear displacement transducer (working minimum range 20-30 mm)	Yes	**TX00036S** 10kN internal submersible load cell. Unique two part construction for improved reliability. Accuracy 0.1% of Full Range Output (FRO). Maximum pressure rating 7MPa. Diameter:79mm Height: 54mm Temperature -20°C to 80°C Temperature compensation to -20°C to 80°C Temperature effect 0.003%/°C Type 9 Load ram and connection kit to be ordered separately to suit triaxial cell and data acquisition unit. Alternative available sizes: 1, 2, 4, 5, 8, 10, 16, 25, 32, 50 and 64kN. **TX00136** Load Ram Assembly for Internal submersible load cell, 25mm plain ram for traditional triaxial cells. Includes cable and DIN plug for GDS PAD data acquisition device. 225mm long with M24 male threads Maximum axial load 50kN.

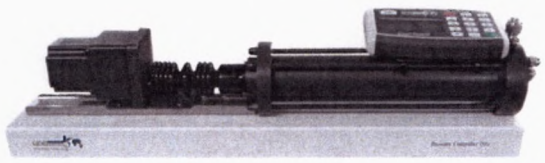
			TX00151 3MPa Pore Pressure Transducer with 5 Pin DIN Plug for GDS Data Interface. Accuracy 0.10% of Full Range Output (FRO) **DWG-MISCELSA0103** De-Airing Block for Pressure Transducer up to 3MPa with non volume change valve. **TX00399** Linear Displacement Transducer with 2m Cable and DIN plug to suit GDS Data Loggers. Linear Strain Type (Strain gauge based). Range: 25mm Accuracy:<0.075% Full Scale Output voltages at 10V excitation (Nominal): 25mm=67-72mV Diameter 19mm (typically requires displacement transducer bracket TX00198 for 25mm ram) **TX00198** Displacement Transducer Bracket Set for 25mm ram 19 mm bore
6.	Software and hardware solution of data acquisition and control of the apparatus (including regimes for constant rate of strain, constant rate of loading, stepped loading and constant axial effective stress)	Yes	**DWG-8CHPADGA0007-P** GDS 8-channel, 24-bit synchronous data acquisition with USB 2.0 interface. +/- 5 Volt excitation with 40mA available for each channel. 12 input gain ranges individually software selectable for each channel from 22mV to 32V. Includes Power and USB Cable. **SW00002** GDSLAB - Kernel Module: GDSLAB modular software kernel module and dongle for Data Acquisition Only. Kernel and security dongle for single GDSLAB licence.- Acquisition Only. Also allows velocity controlled Unconfined Compressive Strength (UCS) tests. **SW00012** GDSLAB Standard Consolidation Module (Consolidation/Rowe/CRS/IST) - Stepped loading - Constant Rate of Strain (CRS) with controlled hydraulic gradient

			- Constant Rate of Loading (CRL) with controlled hydraulic gradient - Controlled Hydraulic Gradient - Saturation Ramp with control of axial stress or axial effective stress - B check - Constant axial stress or axial effective stress
7.	Temperature control system for the minimum range of temperatures 20-100°C	Yes	**EC01588** Temperature Control System (Heating only): Climate controlled version (Ambient to +100°C). The climate control system comprises of:- - Environmental chamber to buffer the cell from changes in atmospheric temperature. - Direct on cell heating elements and cascade RS232 programmable controller. Note: Forced cooling system is not included, cooling is by convection only. It is recommended that this system be used with a separate water bath. Requires 240V single phase supply or step-up transformer. **EC00004** RS232 USB Dual Converter
8.	System for unsaturated soil testing (axis translation method) allowing suctions up to at least 1500 kPa including pneumatic pressure controller and base pedestal with HAE porous disk	Yes	**PNEUSICONF0002-P** 2MPa Single channel pneumatic pressure controller with output for input to a data acquisition system. - Independent control of single pressure channel - Maximum pressure 2000kPa - Does not include volume change measurement. - RS232 interface. Note: Clean and dry compressed air or compressed gas source to be supplied by customer. **A-Design** CRS Cell - 63.5mm UNSAT 15 Bar upgrade for existing 3MPa CRS Cell Includes: Base Pedestal 63.5mm diameter with 15 Bar HAEPD for UNSAT testing in 3MPa CRS Cell, top cap and isolation plate.

9.	Other accessories required for full utilization of the apparatus if not specified above	Yes	**INSTALL03EU** Installation and Training for 3 days (EU)

GDS Pressure/Volume Controller Range (1MPa to 100MPa)

The GDS Pressure/Volume Controllers are microprocessor-controlled syringe pumps for the precise regulation and measurement of fluid pressure and volume change. GDS pressure controllers are available in different models which cover a range of maximum pressures, volumetric capacities, accuracies and wetted materials. While traditionally GDS pressure controllers have been used for supplying highly accurate pressures and measured volumes to soil testing applications, they may be used in any laboratory situation where demands for tightly controlled pressures occur. GDS pressure controllers can be controlled through pressure, volume, and flow rate modes, all from software or via the Smart Keypad.



Enterprise Level Pressure/Volume Controller (ELDPC)

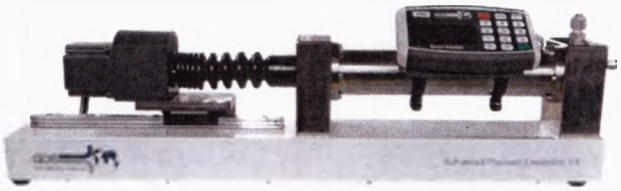
The Enterprise Level Pressure Controller is designed to give a highly competitive entry point in to the GDS pressure controller range. It is only available in one configuration and is the perfect plug and play pressure source.

Pressure Accuracy 0.25% FRO. Working pressure range: 1MPa
Volumetric Accuracy: 0.4%. Volumetric capacity: 200cc

Standard Pressure/Volume Controller (STDDPC)

The Standard Pressure Controller is a step up from the ELDPC in terms of the accuracy class and configurations. While operationally similar, the maximum pressure ranges can be specified up to 4MPa. Maximum flow rates are enhanced as are the resolutions for pressure and volume measurement. The optional remote feedback of external pressure transducers increases control flexibility.

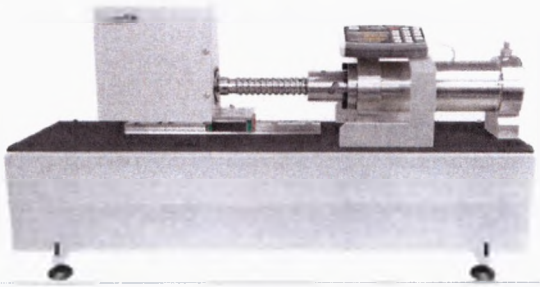
Pressure Accuracy 0.15% FRO. Working pressure range: 1-4MPa
Volumetric Accuracy: 0.25%. Volumetric capacity: 200cc



Advanced Pressure/Volume Controller (ADVDPC)

The Advanced Pressure Controller is the highest accuracy pressure controller available from GDS. Available in multiple pressure ranges and volumetric capacities (1000cc up to 2MPa). All components in the ADVDPC are of the highest quality from ground ballscrews to handmade gearboxes to reduce backlash and increase accuracy.

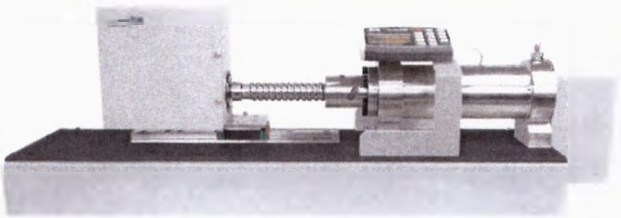
Pressure Accuracy 0.1% FRO. Working pressure range: 0.1-4,MPa
Volumetric Accuracy: 0.1%. Volumetric capacity: 200cc,
(1000cc available at <2MPa)



Advanced High Pressure/Volume Controller (HPDPC)

The High Pressure Advanced controllers maintain the accuracy of the advanced range, and push the pressures higher. With wetted materials, stainless steel and aluminium bronze, it is even more corrosion resistant than the other pressure controller ranges.

Pressure Accuracy 0.1% FRO. Working pressure range: 8-100MPa
Volumetric Accuracy: 0.1%. Volumetric capacity: 200cc



HPDPC-H Hastelloy Version for use with highly corrosive fluids

The GDS HPDPC-H is available for use with harsh environment fluids in all pressure ranges. All wetted parts are made from Hastelloy C-276 with seals utilizing carbon filled PTFE and FFKM o-rings. Volume resolution is increased to 0.01mm^3 to cope with extremely slow rates of flow often required in petrochemical applications.

Pressure Accuracy 0.1% FRO. Working pressure range: 0.1-64MPa
Volumetric Accuracy: 0.1%. Volumetric capacity: 200cc

How does it work?

Liquid (normally deaerated water) in a cylinder is pressurised and displaced by a piston moving in the cylinder. The piston is actuated by a ball screw turned in a captive ball nut by an electric motor and gearbox that move rectilinearly on a ball slide (see Fig. 1).

Pressure is measured by an integral solid state transducer. Control algorithms are built into the onboard microprocessor to cause the controller to seek to a target pressure or step to a target volume change. Volume change is measured by counting the steps of the incremental motor.

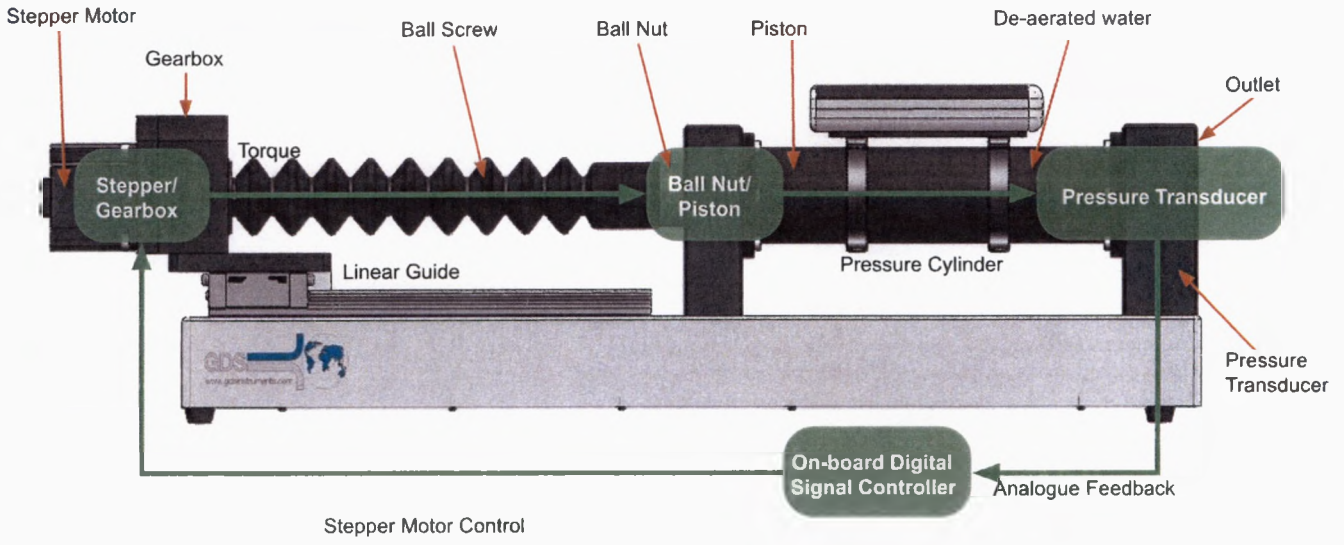


Fig. 1 Schematic of a GDS Standard Level Controller and the extra features of a Digi RFM

How do you use it?

Via a PC: Compatible with the GDSLAB software suite, this windows based application will allow you to operate the device. In its simplest form, a display window shows the current pressure and volume.

Using a Smart Keypad

Simply plug the Smart Keypad into the Controller and the Smart Keypad will automatically recognise the controller and display the current pressure and volume.

Key Features:	Benefits to the User:
Single connection to electrical power:	GDS pressure controllers do not rely on lab air supplies.
USB and Smart Keypad user interfaces:	The GDS pressure controllers can be controlled directly from a computer using the USB 2.0 interface or the Smart Keypad. Using the Smart Keypad, the controller can be configured as a completely stand-alone device.
Pressure is measured by an integral pressure transducer. Volume change is measured by counting the steps of the incremental motor:	Accurate measurements of pressure and volume as both are measured locally to the controller.
Self-protecting and can be programmed to protect any attached equipment:	Full confidence that the equipment is inherently safe and can never be over-ranged.
Measurement of change in volume with no requirement for a separate volume change device:	Controllers are an ideal back-pressure source.
All controllers are designed to run using liquids. GDS have an ADVDPC (1000cc) specifically designed for use with Air:	Controllers can be used with a large range of media.

Choosing the right controller:

Enterprise Level, Standard, & Advanced Pressure/Volume Controllers Comparison Chart

Feature	ELDPC Pressure/Volume Controller	STDDPC Pressure/Volume Controller v2	ADVDPC Pressure/Volume Controller v4	HPDPC and HPDPC-H Pressure/Volume Controller
Pressure range:	1 MPa	1, 2, 3, 4 MPa	0.1, 0.2, 0.4, 0.8, 1, 2, 4 MPa	8, 16, 32, 64, 70, 100 MPa
Pressure accuracy:	0.25% FRO	0.15% FRO	Better than 0.1% FRO	Better than 0.1% FRO
Pressure resolution:	1 kPa	0.1 kPa (1MPa) 1kPa (2MPa-4MPa)	0.1 kPa	1 kPa
Resolution of logging via software:	1 kPa (1000 device)	0.1 kPa (1 MPa) 1kPa (2MPa-4 MPa)	0.1 kPa (2000 kPa device)	1 kPa
Pressure calibration:	One point calibration (FRO)	One point calibration (FRO)	Multipoint calibration, certified with table	Multipoint calibration, certified with table
Volumetric range:	200 cc	200 cc	200 cc, 1000 cc (<2 MPa only)	200 cc
Resolution (volume):	1 mm^3 (0.001 cc)	1 mm^3 (0.001 cc)	0.1 mm^3	0.1mm^3 (optional 0.01mm^3)
Volumetric accuracy:	0.4% measured	Better than 0.25%, calculated	Better than 0.1%, certified	Better than 0.1%, certified
Resolution of control:	1 kPa	0.1 kPa (1 MPa) 1 kPa (2 MPa-4 MPa)	0.1 kPa (2000 kPa device) 0.1 kPa (>2000 kPa device)	1 kPa
Ball screw:	Rolled – lead error 100 µm in 330 mm	Rolled – lead error 100 µm in 330 mm	Ground – lead error 25 µm in 330 mm	Ground – lead error 25 µm in 330 mm
Linear guide:	Rolled – error unspecified	Rolled – error unspecified	Ground – running parallelism error 20 µm in 500 mm	Ground – running parallelism error 20 µm in 500 mm
Gearbox:	Class C	Class C	Class A precision	Class A precision
Interface options:	USB	USB	USB	USB
DigiRFM Compatible	No	Yes	Yes	Yes
Material and finish of pressure cylinder:	Brass, painted	Brass, painted	Brass, bright nickel plated and polished	8,16,32 Brass 64,70,100 Stainless Steel (All HPDPC-H controllers made from Hastelloy)
Size (mm):	500 x 100 x 125	620 x 100 x 140	670x100x190 (4MPa/200cc) 670x100x190 (2MPa/1000cc)	860x230x260 (8-32 MPa) 860 x 230 x 330 (64 MPa)
Weight:	5.5 kg (empty)	10.2 kg (empty)	0-4MPa 17 kg (empty)	8-32MPa 20kg (empty) 64-100MPa 25kg (empty)
Electrical supply (universal):	100-240V AC, 50-60Hz, 0.7A. Max Consumption: 20W. Typical Consumption: <12W	100-240V~1.6A MAX, 50- 60Hz	85 VAC to 260 VAC; 47 – 440 Hz	100-240V AC, 50-60Hz, 0.7A. Max Consumption: 20W. Typical Consumption: <12W

Optional: Digital Remote Feedback Module (Digi RFM)

Normally, the feedback to the main control circuit board comes from the internal pressure transducer. However, this input could come from a different source, such as a remote transducer. GDS has developed this into an elegantly engineered enhancement which is the Remote Feedback Module (RFM).

The RFM (see Fig.3) enables the output of an external transducer to be measured and displayed by the controller. It also enables the piston action to be controlled from the feedback of the external transducer. Both the internal pressure transducer and the external transducer readings are displayed and transmitted over the computer interface. Benefits of the Digi RFM include:-

Fig. 3 Optional Digi RFM

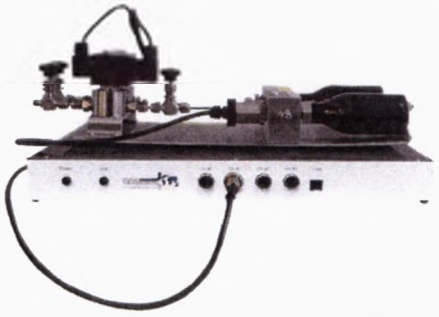
- Precision when regulating from the external transducer, as it can be positioned closer to the experiment.
- Can increase the accuracy of the application by choosing a transducer closer to the range of the experiment.
- Can be used with wet wet differential pressure transducer to increase the accuracy and measurement, e.g. for precise control between back pressure and cell pressure for accurate measurement and control of effective stress.

Alternatives/Options

Pneumatic Controller

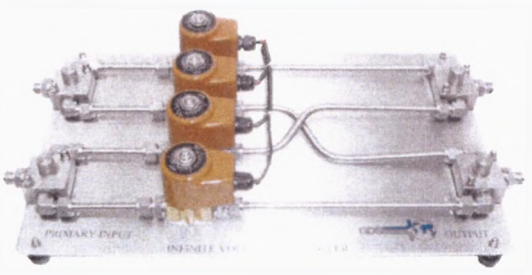
The GDS pneumatic controller is an economical source of computer controlled regulated air pressure control. The controller regulates an external pressure source such as a compressor or compressed air cylinder to provide a controlled output pressure.

The control of the valves is via the Serial bus (RS232) from the PC and software.



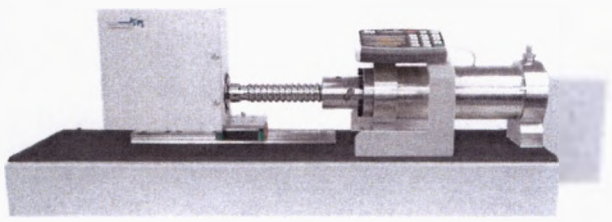
High Pressure Gaseous Controller

The GDS High Pressure Gaseous controller (HPGC) has been designed to effectively replace manual regulators within systems. The HPGC is capable of setting pressures and controlling pressure ramps while recording the pressure via built-in high accuracy pressure transducers. Additional pressure transducers can also be added to the system if required.



Infinite Volume Controller

The GDS Infinite Volume Controller (IVC) is designed to remove constraints of volume capacity such that a test can continuously flow fluid under pressure control or volume control. When using a single pressure/volume controller, once the volumetric capacity of the barrel has been reached (either 100% full or 100% empty), the user is required to manually fill or empty the controller accordingly. By connecting two GDS pressure/volume controllers in parallel, the IVC system automatically switches between them when they run out of volume thus providing a seamless supply of pressure with unlimited volume capacity.



Advanced High Pressure/Volume Controller - Corrosive Fluid Version (HPDPC-H)

The GDS High Pressure Syringe Pumps are positive displacement pumps that have been developed from the proven pressure controller range that GDS Instruments have been making for over 40 years. The HPDPC-H version has been enhanced with features that are ideal for core testing and reservoir analysis. These include flow rate control, enhanced resolution and the use of high corrosion resistance Hastelloy. With the ability to operate in pressure, volume or flow control modes, either directly from the keypad or remotely via software, the HPDPC-H is a versatile and simple to use pump.

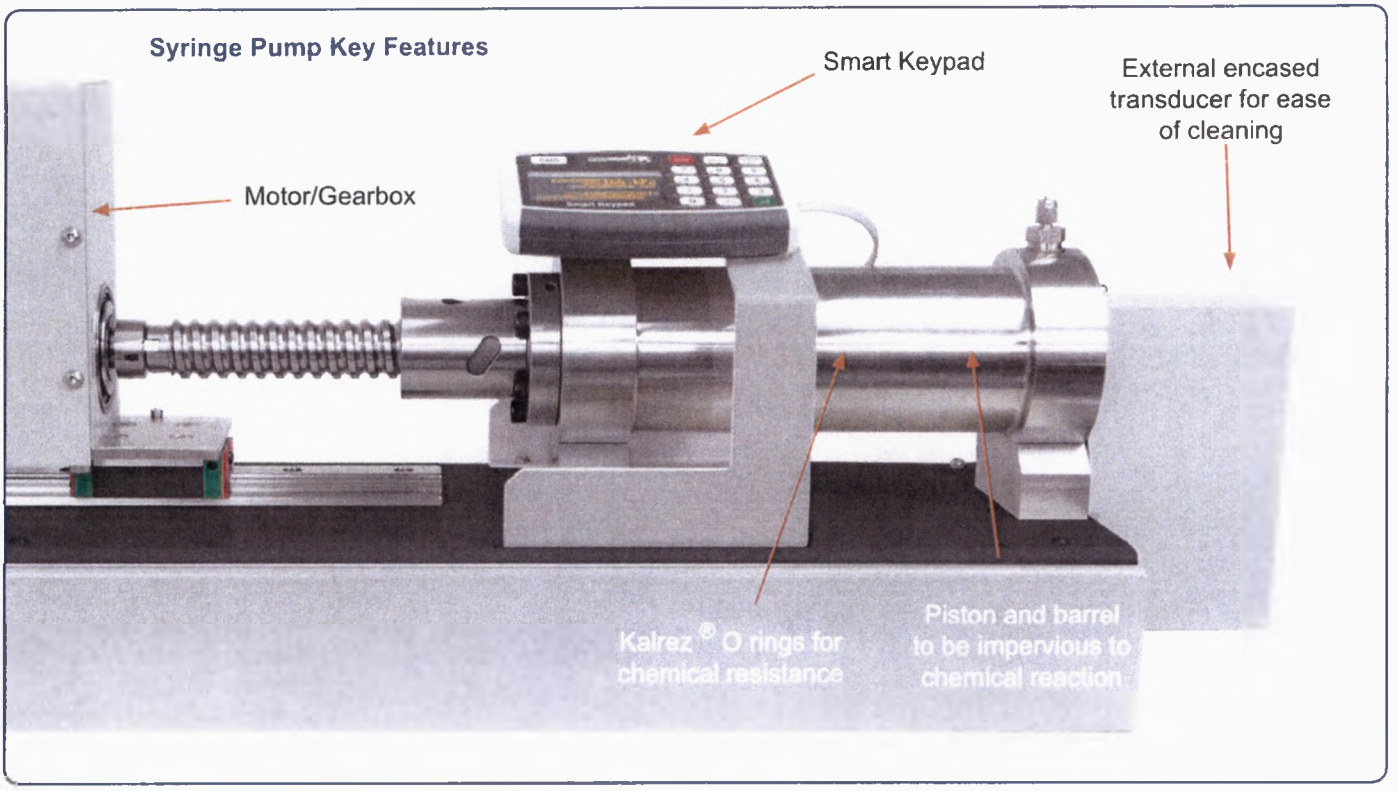
All wetted metallic parts made from Hastelloy C-276 with seals utilising Carbon filled PTFE and FFKM o-rings. This provides a highly corrosion resistant version for use with aggressive fluids that can be present in deep cores.

Key Features:	Benefits to the User:
Hastelloy barrel, piston and transducer:	A superalloy, Hastelloy has outstanding resistance to highly oxidizing and reducing agents, making it a great choice for severe corrosive environments.
5 part composite carbon filled PTFE seals and FFKM o-rings:	Corrosion resistant seals way beyond what any rubbers can resist.
Bi-metallic anti-abrasive aluminium-bronze guidance ring:	Although all wetted parts of the controller are Hastelloy, the important components that are required to ensure free running and long life of the controller are still designed in around the Hastelloy components.
Increased resolution of volume change as standard:	The increased resolution allows extremely slow flow rates to be resolved.
Externally mounted Hastelloy/ceramic pressure transducer:	Being externally mounted means it can be easily flushed/cleaned.
Controllers can be used with different fluids:	Suitable for a wide range of applications in varied fields like petrochemical applications, EOR, reaction feed, alternative fuels, biomass, etc.

Performance Specifications

Pressure	Working Range	up to 64MPa
	Accuracy	0.1% FRO
	Resolution	1 KPa
Volume	Capacity	200 mL
	Accuracy	0.1% measured valve (±5mm³ below 100 kPa)
	Resolution	0.0001 ml
Flow	Minimum Rate	0.00001ml/min
	Maximum Rate	22.5ml/min
	Accuracy	0.5%
Expected Seal Life (Water)	Greater then 2 years	

Syringe Pump Key Features



Syringe Pump Applications:

The GDS Hastelloy High Pressure Syringe Pump can handle fluids of various substances and viscosities like liquefied gases, viscous fluids, pastes and slurries, as well as hazardous and corrosive materials.

The HPDPC-H can be used as advanced fluid delivery and control tools in a variety of applications in academic/research, energy, chemical and petrochemical, pharmaceutical and other fields. Indicative applications of the HPSP are:

- Supercritical fluid applications in materials production
- Reaction feed
- Enhanced Oil Recovery (EOR), reservoir engineering and other petrochemical applications
- Core flow analysis
- Alternative fuels, biomass

The HPDPC-H can be customised to meet the specific requirements of your application.

50kN Load Frame (GDSLF50)

Overview: The GDS 50kN laboratory load frame can be used via standalone keypad operation or via USB interface for computer control. This load frame has enhanced position/ velocity accuracy and direct load/local position control by DigiRFM upgrade while still fulfilling the role of a traditional velocity controlled 50kN load frame.

The GDSLF50 includes a large built-in OLED graphic display that shows current speed, displacement, DigiRFM values and can be used for stand-alone programming.

Standards:

BS1377:7 | BS1377:8 | ASTM D-2850 | ASTM D-4767 | ISO17892-8,9 | NFP94 070

Key Features:	Benefits to the User:
Displacement control:	Traditional load frames only operate in speed/velocity control mode. All GDS load frames can also operate in displacement control mode via their keypad or software. This function is very useful in setting up or breaking down a test, and provides higher fidelity control than a velocity only frame can achieve.
Status indicator:	Directional & velocity indicator LEDs show at a glance how the frame is moving. A bright status light under the display indicates frame status and is visible from afar when indicating any error.
Safety loop:	While under computer control the USB connection status is continually monitored by the load frame. If a break in communication is detected the load frame will stop automatically to ensure no damage to sample or transducers can occur. This has saved many test specimens as well as test equipment when brief powercuts occur or laptop batteries have run out of charge during a test.
Digi RFM Upgrades	Up to 2 DigiRFM units can be added to the loadframe to enhance its performance by giving high rate closed loop control within the frame. The most typical use cases for this are: 1. To connect a loadcell or local displacement transducer for direct control – this allows for more aggressive tracking of load/displacement. 2. To provide a self-contained system with no other acquisition for UCS or oedometer tests where load and local displacement are logged via the frame.

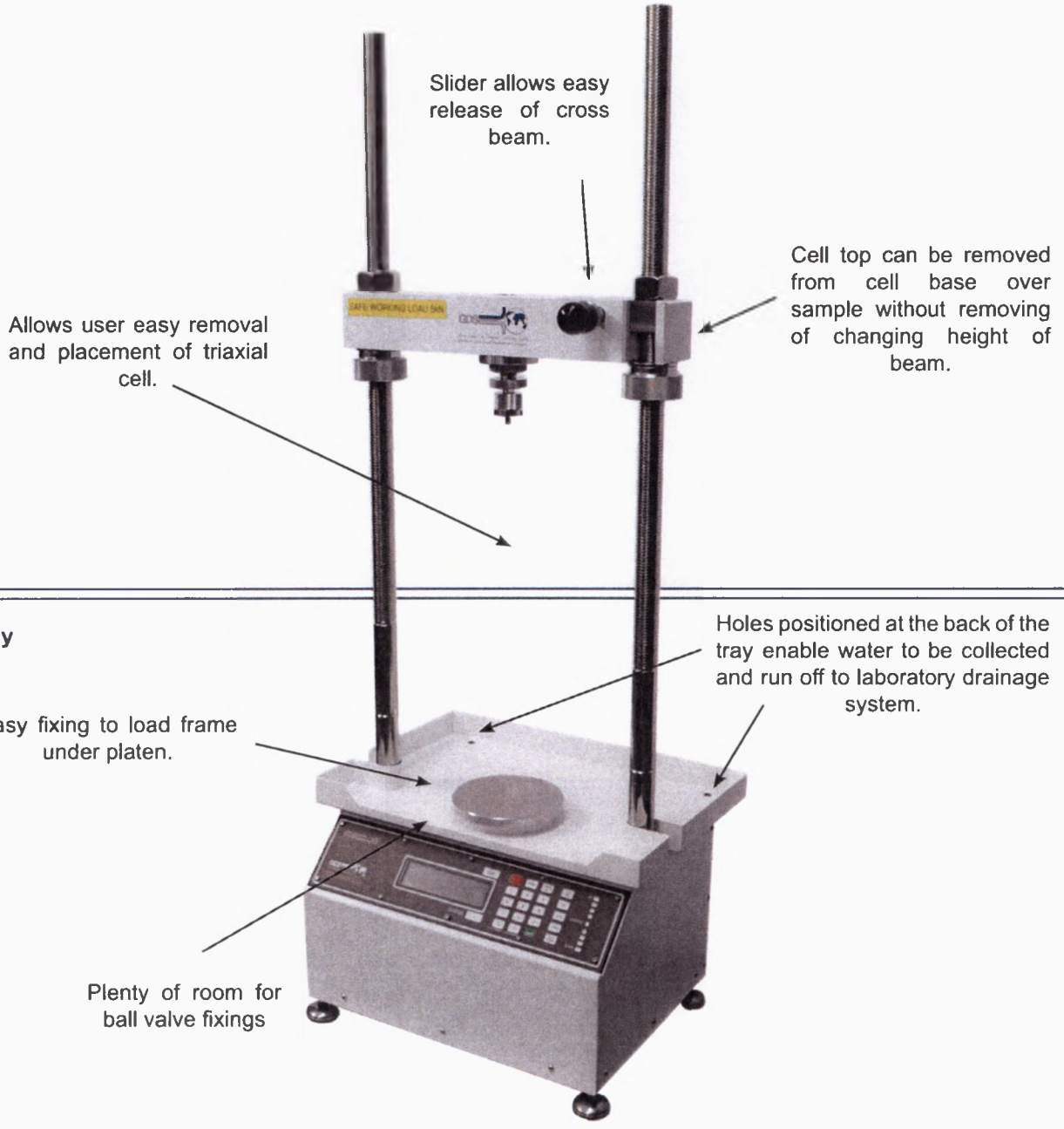
Tests that can be Performed: Triaxial (Quick Undrained, UU, CU, CD), Stress Path, K0, Unsaturated Triaxial, Stepped loading, CRS, CBR and UCS.

Technical Specification:

Maximum Load (Compression) (kN):	50
Maximum Load (Tension) (kN):	15 using upper ball connection, 50 with upgraded connection
Speed range(mm/min):	0.00001 to 89.9999
Travel (mm):	100
Platen Diameter (mm):	158
Communication port:	USB
Horizontal daylight (mm):	380
Vertical daylight (mm):	800 (crossbeam to platen)
Weight (kg):	95
Dimensions (mm):	475 x 360 x 1430 (w x d x h)
Power:	90-240V, 50/60Hz, single phase

Upgrade Options: Drip tray and swing arms available. DigiRFMs for additional data acquisition and/or closed loop control from other local transducers.

Swinging Arm



Drip Tray

Fig 1. Shows the swinging arm and drip tray options on a GDSLF50.

Optional closed loop feedback control using Digital Remote Feedback Module (Digi RFM)

Open Loop (no RFM)

Typically, velocity controlled load frames are used with no transducer feedback as the velocity is set and considered to be correct (open loop).

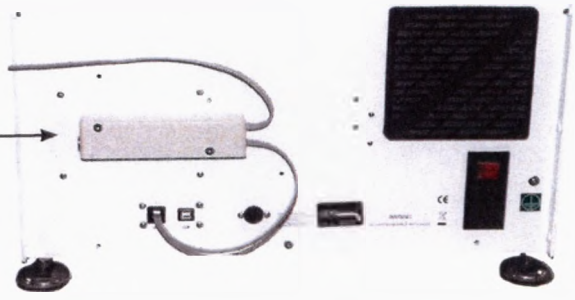
Closed Loop (no RFM) see Fig 3

Using GDSLAB control and data acquisition software the load frame can be controlled under a closed loop via the software (the software reads the appropriate transducer from a data acquisition device, and the software sends commands to the load frame to achieve particular targets for that external transducer). This can work extremely well and allows a velocity controlled load frame to successfully be used for accurate strain controlled tests where the measurement of strain is closer to the sample thus removing system compliance, or load/stress controlled tests as routine.

Closed Loop (RFM) see Fig 4

The next logical level is to create closed loop control of either displacement or load (or both) within the load frame. GDS has developed this into an elegantly engineered enhancement which is the Remote Feedback Module (RFM). The RFM (see Fig 2.) enables the output of a number of external transducers to be measured and displayed by the load frame and via software. It also enables the load frame platen to be controlled directly from the feedback of the external transducer.

Fig 2. DigiRFM attached to the back of the load frame and connects via the CAN bus/



Benefits of the DigiRFM include:-

- Precision when regulating from the external transducer due to closed loop control.
- Closed loop control ensures a faster more direct response to load/displacement targets.
- Load control and/or displacement control can be achieved on the load frame in stand-alone mode without the requirement for software.

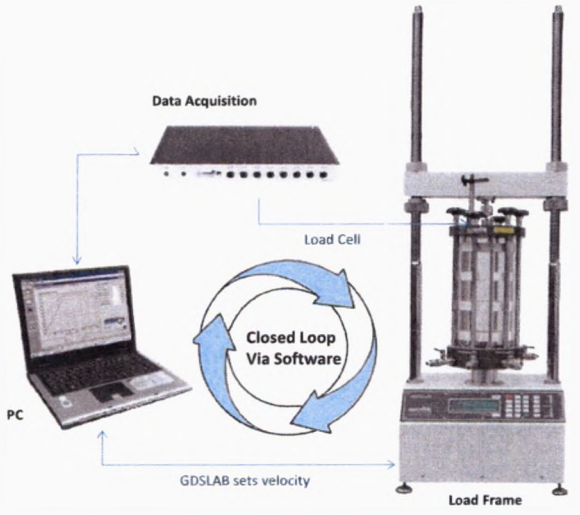


Fig 3. Closed-loop control via software feedback.

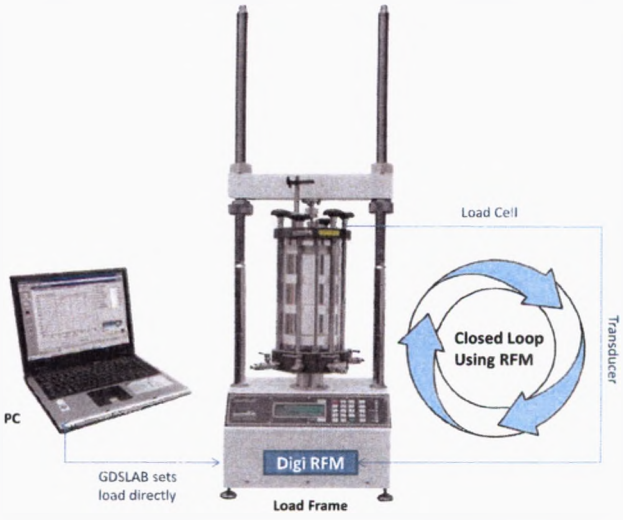
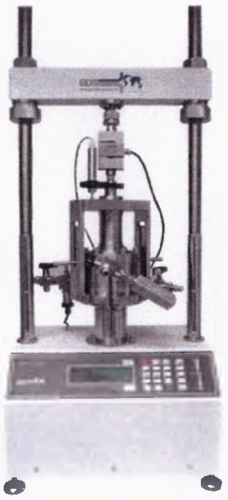


Fig 4. Closed-loop control via RFM fedback.



20 MPA pressure cell in loadframe

Constant Rate of Strain Cell (CRS)

The GDS Constant Rate of Strain Cell (CRS) is a load frame based one dimensional consolidation cell capable of applying back pressure and measuring pore pressures up to 1MPa (low pressure version), 3MPa (medium pressure version), or 20MPa (high pressure version). Coupled with GDS Controllers and software, the system will run the entire test from start to finish through a loading path specified by the user using constant rate of strain loading.

Key Features:	Benefits to the User:
Stress control:	As well as constant rate of strain, stress may be applied on a constant (creep tests) or incremental basis identical to a traditional oedometer.
Constant rate of strain with controlled back pressure:	Drainage is through the base of the apparatus meaning excess pore pressure can be monitored and controlled. Tests can run whilst maintaining a specified maximum excess pore pressure, therefore increasing specimen throughput due to faster testing times.
Program the entire test from start to finish with multiple test stages:	More efficient testing as no waiting for user inputs.
Interchangeable range submersible loadcell:	Enables the user to run tests on soils of significantly different stiffness, and match the load transducers accordingly, giving greater accuracy of results, plus seal friction does not effect load readings.
Construction material:	Anodised aluminium with perspex outer cell wall for long life (1MPa and 3MPa versions), or full stainless steel (20MPa version).
Integral cutter/sample ring:	Disturbance on samples is reduced by having a cutting edge integrated into the sample confinement ring.

Tests that can be Performed:

Constant rate of Loading (CRL) Consolidation, Constant rate of strain (CRS) Consolidation, Consolidation Testing, K0 (K-Zero), Multi-stage Testing, Oedometer/Consolidation, Constant Head Permeability, Pore Water Volume Change, Quasi-Static (low speed/creep) Tests, RAMP and CYCLE pressure or volume change (Saturation Ramp), Axial Compression, Load Control (Static), Static Displacement, Static Load, Stepped Loading.

Upgrade Options:

Unsaturated testing, Bender Element testing, Temperature control and Permeability testing.

Technical Specification:

Load Range (kN):	High Pressure: 100, Medium and Low Pressure: 50
Pressure Range (MPa):	High Pressure: 20, Medium Pressure: 3, Low Pressure: 1
Sample Sizes (mm):	High Pressure: 38, 50, Low Pressure: 38-100
Construction Material:	High Pressure: All stainless steel, Medium and Low Pressure: Anodised aluminium with perspex outer cell.

How does it work?

Instead of applying stress increments in stages as in a typical oedometer consolidation test, the load can be gradually applied to the sample by increasing the axial stain at a constant rate. Controlled back pressure (water) is applied to the sample and drainage is allowed through the base of the apparatus. The advantage of this method is that the time required to complete a consolidation test can be reduced significantly by maintaining close control of the excess pore pressures generated.

System Elements

A GDS pressure controller is used to apply the back pressure. A standard load frame controls the vertical stress and strain, with strain rates typically up to 100mm/min. A force transducer placed at the end of a piston measures the force, and pore pressure is measured by a transducer connected to the base filter stone. The sample itself is confined between two porous plates in a steel ring, which prevents horizontal deformation and reduces friction. The low/medium pressure cells (see Fig.1 below) are designed to be used with an internal submersible load cell, whereas the high pressure version (see Fig.2 below) is used with an external load cell only. GDS also have the option for an open-topped CRS cell see Fig 3. This is like a traditional oedometer cell but has a sealed lower porous disc allowing pore pressure measurements to be taken at the base of the specimen.

Fig 1. Low/Medium pressure cell (1 and 3MPa)

Fig 2. High pressure cell (20MPa)

Fig 3. Open-topped CRS

Temperature Control:

GDS' Constant Rate of Strain cell is available with temperature control. It is available with heating from ambient to 65°C or ambient to 100°C. This cell is high pressure (up to 20MPa) and can accommodate sample sizes up to 50mm.

The load frame actuated cell can fit a number of different load frames. Other temperature ranges including heating and cooling are available upon request.