

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:

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, 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
Displacement Resolution:	1 micron
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, 10
Operating Frequency (Hz):	5, 10
Pressure Range (MPa):	1
Sample Sizes (mm):	38, 39.1, 50, 54, 61.8, 70, 76, 100, 101 or 150

Systems Elements & Options

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

ELDCS Acquisition Pad

The ELDCS provides 4 channels of ultra-high resolution 24-bit data and a single additional incremental quadrature input channel. The 4 channels of fixed-gain inputs can be customised at the factory to enable any transducer in the GDS range to be connected via the industry standard DIN connector. Multiple ELDCS boxes can be joined via the CAN connector to provide synchronised data acquisition and control.

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.



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



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

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.

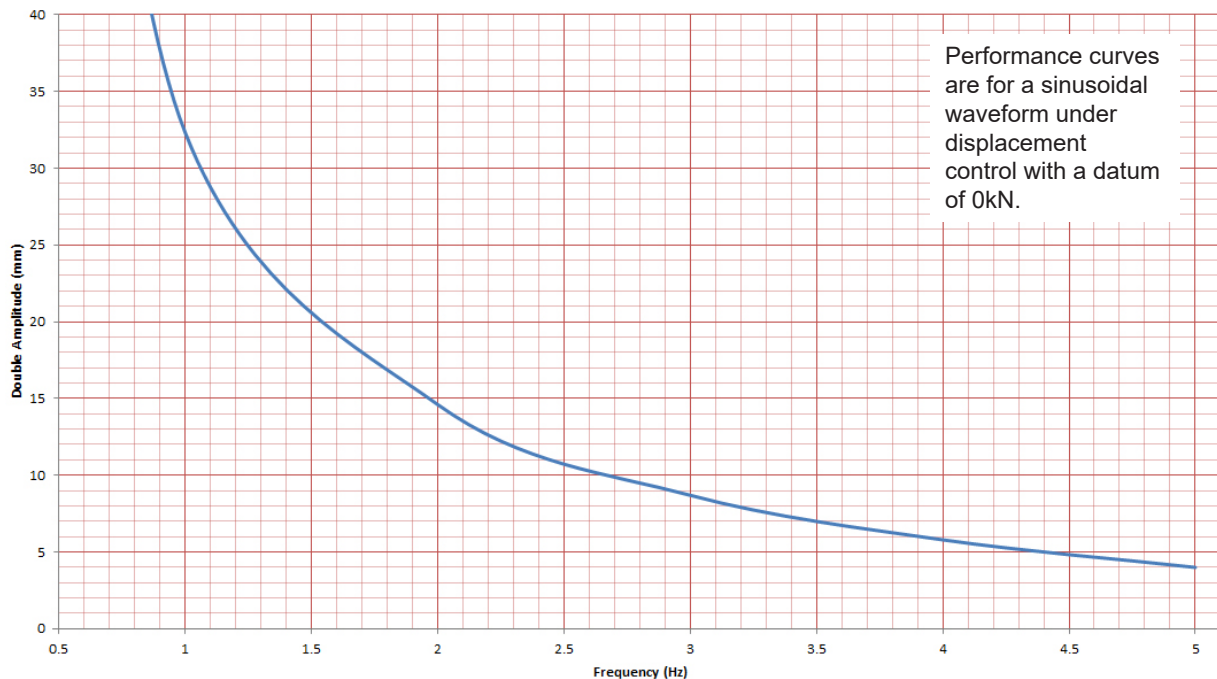
Load Range (kN)

- 5 & 10

Specimen Sizes (mm)

- 38, 39.1, 50, 54, 61.8, 70, 76, 100, 101 or 150

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



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 ELDYN 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 (ADVDP) 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

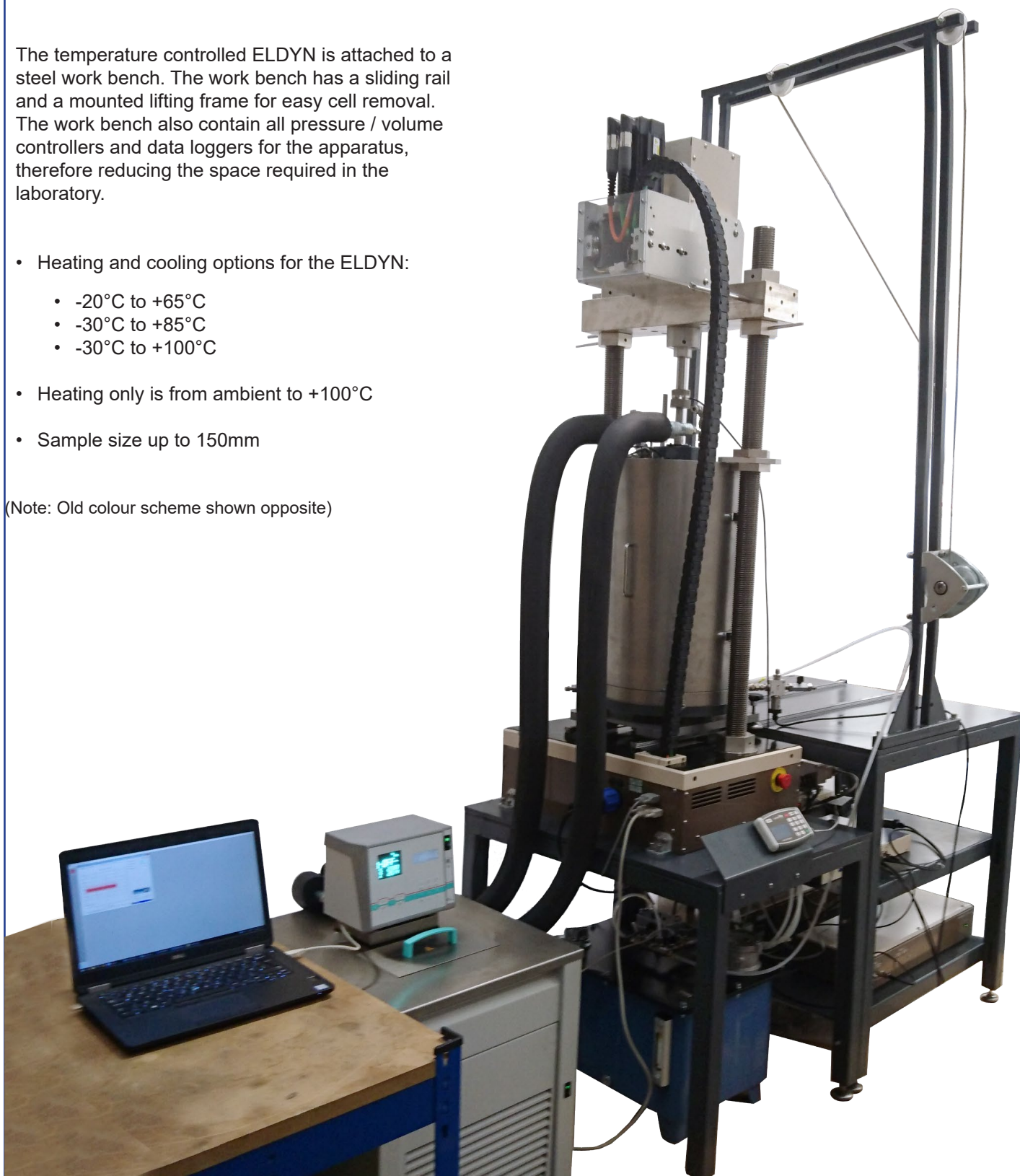
For further information on unsaturated testing methods, please refer to the unsaturated datasheet.

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

(Note: Old colour scheme shown opposite)



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.

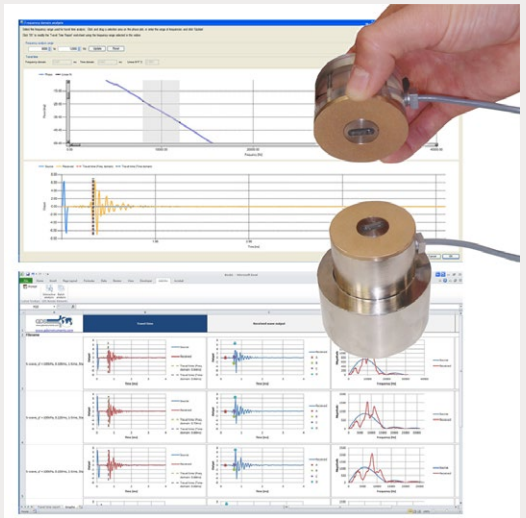


Fig. 4 Shows screenshots of the GDSBEAT software.

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.

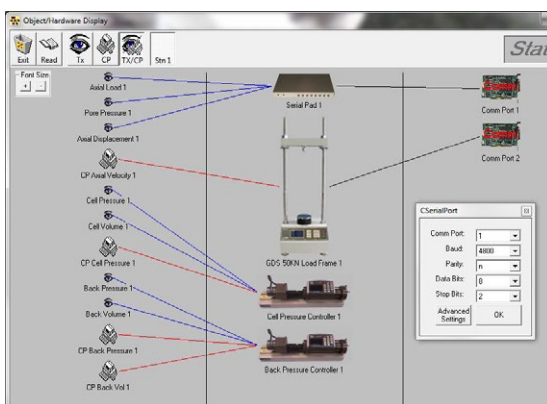


Fig. 5 Show a typical set-up screen in GDSLAB

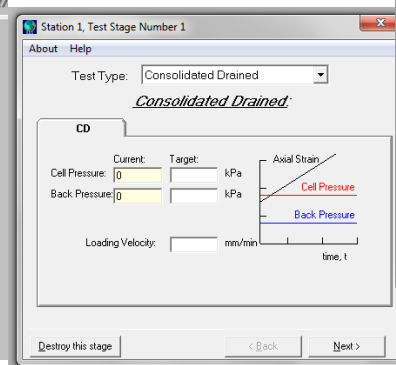


Fig. 6 Show a typical station test stage set-up in GDSLAB

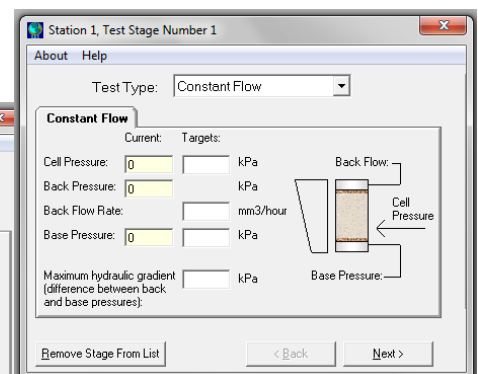


Fig. 7 Show a typical station test stage set-up in GDSLAB

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.

ELDCS Acquisition Pad Used for ELDYN



Overview: The ELDCS is our Enterprise level Analogue Acquisition and Control System designed for mid range dynamic testing and control. The ELDCS has been fully designed and developed by GDS' in-house engineering team and fits neatly as a lower cost version of the ADVDCS v2, with many of the same features that would be expected from a high level dynamic control system, but with a more economical price point.

The ELDCS provides 4 channels of ultra-high resolution 24-bit data and a single additional incremental quadrature input channel. The 4 channels of fixed-gain inputs can be customised at the factory to enable any transducer in the GDS range to be connected via the industry standard DIN connector. Multiple ELDCS boxes can be joined via the CAN connector to provide synchronised data acquisition and control.

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.

Technical Specification:

Connection to PC:	USB
Acquisition Channels:	4 Analogue + 1 Quadrature Decoder
Control Channels:	1 Analogue
Multi Box Capability:	x4
Max Number of Channels:	Up to 16 analogue + 4 quadrature channels with synchronised data acquisition
Sample Rate:	500Hz
Resolution:	24 bit, 16,777,216
Gain Ranges:	8 (preconfigured at factory)
Description:	Enterprise level solution for dynamic acquisition and control.
Voltage Resolution:	~ 0.000001 mVolts (1 nanovolt)
Voltage Input Type:	Fully Differential, Balanced Precision Inputs with Integrated Signal Conditioning
Transducer Excitation Voltage:	Differential, Fixed Precision +/-5V, Independent (not Ganged), Ratiometric Excitation
Number of Input Ranges:	Pre-Configured Single Fixed Gain per Channel. Each channel can be individually customised at the factory to meet application requirements from +/- 10mV to +/- 10V. Standard setup is 1 channel +/-10V, 2 channels +/- 200mV, 1 channel +/- 30mV.
Excitation Fault Tolerance:	Independent Per Channel, if any channel is shorted the other channels will continue to operate normally
Current Input Mode:	Yes - Via resistor fitted in cable termination (different ranges possible)
Differential Measurement Range:	-10mV...+10mV to -10V...+10V for balanced differential signals
Transducer Calibration:	Linear
Data Acquisition Options:	Digital filtering for noise reduction
Digital Control:	500 Hz 32-bit floating point control loop
Analogue Control:	Support for Analogue motor drives only
Compliance Estimation:	Set by user
Adaptive Control:	Cycle-by-Cycle Reference Adaptation
Custom Waveforms:	Repetitive custom waveforms with 256 points per cycle. Waveform streaming direct from file.
Sample Docking:	Manual
Display and Monitoring:	Data acquisition in GDSLab via USB interface, High resolution real time graphs
Software:	GDSLAB
System Characteristics:	40MHz 16-Bit Digital Signal Controller with Analogue Control Outputs
Minimum System Requirements:	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.

