

## Resilient Modulus Testing System (RMTS)



**Overview:** The GDS Resilient Modulus Testing System (RMTS) enables the resilient modulus and permanent deformation of unbound base/sub-base pavement materials to be determined. The system, based around the GDS ELDYN, uses an axially-stiff load frame with a beam mounted electro-mechanical actuator to apply dynamic cyclic axial loads, with a GDS triaxial cell used to confine the test specimen. A number of options are also available for measuring axial deformations, ranging from localised LVDTs to external linear potentiometers.

### Standards:

AASHTO T 307

AG:PT/T053

AS 1289.6.8.1

### Key Features:

### Benefits to the User:

Electro-mechanical load frame:	The RMTS load frame supersedes 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.
Easy hardware configuration for specific test standards:	Numerous RMTS hardware configurations can be selected, enabling resilient modulus and permanent deformation to be determined by following most published test standards. This flexibility allows for a range of specimen sizes to be tested, confining pressure to be measured at various locations, and specimen deformations (axial and radial) to be recorded via localised or external displacement transducers.
Straightforward test automation via GDSLAB test module:	Pre-conditioning, resilient modulus, permanent deformation and constant stress test stages can all be automatically performed via the Resilient Modulus test module within GDSLAB.

### Technical Specification:

<b>Actuators:</b>	Highly accurate dynamic electro-mechanical actuator
<b>Axial Displacement Encoder:</b>	Yes
<b>Load Range (kN):</b>	5, 10
<b>Computer Interface:</b>	USB
<b>Data Acquisition:</b>	16 Bit
<b>Deformation Measurements:</b>	Local (axial and radial options available) or external
<b>Operating Frequency (Hz):</b>	10
<b>Pressure Range (MPa):</b>	1
<b>Specimen Diameters (mm):</b>	70, 71, 100 or 150

### Optional Extras:

Vertical Bender Elements	50, 70, 100, 150mm
Horizontal Bender Elements	50, 70, 100mm
LVDT Local Strain Transducers	50, 70, 100mm
Unsaturated Testing	Available

## Systems Elements & Options

The fundamental RMTS hardware elements are shown below.

### 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, such as the Resilient Modulus test module, are added for your testing requirements.



**Note:** Connection via USB Interface to PC

### 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.



Optional: Additional ELDCS system can be added for more data acquisition channels.

Cell Pressure (kPa)  
Axial Deformation (mm)  
Load Cell (kN)

Load frame control

Cell pressure



### Pressure Controller & Pressure Measurement

The cell pressure is controlled by a GDS 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 cell pressure is measured by a pressure transducer directly attached to the triaxial cell.

- Accurate to 0.15% of full range output, a GDS pressure transducer provides accurate measurement of the confining pressure applied to the test specimen.

### Frequency Range (Hz)

- 10.

### Load Range (kN)

- 5 & 10

### Specimen Sizes (mm)

- 70, 71, 100 or 150

## RMTS Configurations for Specific Test Standards:

The RMTS can be configured to enable resilient modulii and permanent deformations to be determined by following most published test standards.

### AASHTO T 307

The RMTS configuration for the AASHTO T 307-99 test standard contains the following major hardware and software items (other options available on request):

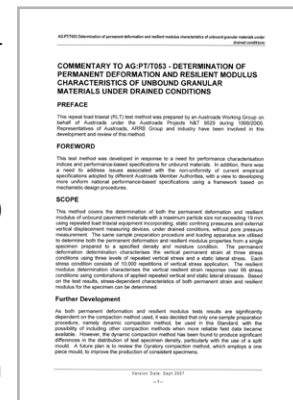
- 5kN/10Hz load frame
- 1x ELDCS for control and data acquisition
- Triaxial cell for up to 100mm diameter test specimens
- 2x +/- 2.5mm DC-DC LVDT transducers for external deformation measurement
- 1MPa GDS pneumatic controller
- 250kPa cell pressure transducer
- GDSLAB with Resilient Modulus test module



### AG:PT/T053

The RMTS configuration for the AG:PT/T053 test standard contains the following major hardware and software items (other options available on request):

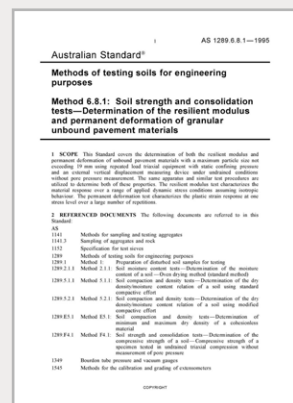
- 5kN/5Hz load frame
- 1x ELDCS for control and data acquisition
- Triaxial cell for up to 100mm diameter test specimens (includes transducer access ring)
- 25 mm external displacement transducer for permanent deformation measurement
- 1MPa GDS pneumatic controller
- 500kPa cell pressure transducer
- GDSLAB with Resilient Modulus test module
- Optional: 2x +/- 5mm submersible LVDT's for internal resilient modulus deformation measurement (includes signal conditioning). Will require an additional 1x ELDCS.



### AS 1289.6.8.1

The RMTS configuration for the AS 1289.6.8.1-1995 test standard contains the following major hardware and software items (other options available on request):

- 5kN/5Hz load frame
- ELDCS for control and data acquisition
- Triaxial cell for up to 100mm diameter test specimens
- +/- 10mm DC-DC LVDT transducer for external deformation measurement
- 1MPa GDS pneumatic controller
- 500kPa cell pressure transducer
- GDSLAB with Resilient Modulus test module



## ELDCS Acquisition Pad Used for RMTS



**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:

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

