Servo-Pneumatic Universal Testing Machine
CRT-UTM-NU

Rapid determination of modulus, permanent deformation and fatigue of bituminous mixtures using cylindrical specimens that are cored from the highway or prepared in the laboratory.
BRIEF INTRODUCTION

This machine is a development of the NAT which was developed by Keith Cooper and Professor Steven Brown at the University of Nottingham. The use of a high precision servo-pneumatic valve in conjunction with a low-friction actuator and sophisticated data acquisition and control, results in a performance that is equal to many servo-hydraulic systems.

Accurate, digitally generated waveforms are applied by the actuator producing repeatable stress variations in test specimens that are simulative of those in a road pavement due to moving traffic. The actuator is double-acting allowing both compressive and tensile forces to be applied. A triaxial cell system is available for the measurement of the resilient modulus of unbound materials.

SYSTEM ELEMENTS

The CRT-UTM-NU is comprised of:

- A rigid stainless steel test frame with adjustable height cross-head
- A precision servo-valve with ceramic spool
- Pneumatic actuator with low friction seals and integral stroke transducer
- Load transducer (±20kN capacity)
- Advanced data acquisition system*
  » 20 bit resolution, 5kHz per channel
  » Will accept variable standard type voltage transducers in any channel using TEDS
  » Arbitrary waveform generations upto 1024 data points per cycle
  » Up to 16 digital input & output channels
  » Ethernet/USB/RS232 to PC communication

* Available late 2012
Servo-Hydraulic Universal Testing Machine
CRT-UTM-HYD

A new generation of Universal Testing Machine combining state of the art technology with proven reliability and precision for research and standard testing
**BRIEF INTRODUCTION**

The Servo-Hydraulic Universal Testing Machine (CRT-UTM-HYD) is a well designed, inexpensive machine specifically developed for the testing of materials used in pavement construction.

A motorized, adjustable crosshead reduces the time between test setups. The programmable temperature cabinet provides the possibility to perform frequency/temperature sweeps. Accurate waveforms are digitally generated and applied by the actuator producing repeatable conditions that are simulative of those created by moving or static vehicles. The actuator is double-acting allowing both compressive and tensile forces to be applied. Various systems are available for the measurement of the modulus of unbound materials.

**KEY FEATURES**

- Designed to perform a range of tests on asphaltic paving materials, sub-grade soils and granular sub-base materials
- Double acting fatigue rated hydraulic actuator with integral stroke transducer
- Utilises Star servo valve with ‘Sapphire Technology’
- Motorised adjustable lower crosshead with automatic hydraulic frame clamping
- Integral programmable temperature controlled cabinet
- Issued with UKAS accredited certificate of calibration for EN 12697-24; EN 12697-25, EN 12697-26
- Accessories available to perform a range of standard and non standard test methods
- Can be supplied with standard software to perform EN, ASTM and AASHTO test methods and universal software with which to design non standard test routines

**KEY USES**

- Assessment of resistance to permanent deformation (rutting)
- Measurement of stiffness modulus
- Assessment of resistance to fatigue cracking
- Resilient modulus of unbound materials
- Mix design

**SYSTEM ELEMENTS**

The CRT-UTM-HYD is comprised of:

- A rigid stainless steel loading frame
- An externally mounted fatigue rated hydraulic actuator with Star servo valve
- A sophisticated data acquisition and control system
- An integral temperature controlled cabinet -20 to 30°C with double glazed viewing door
- A motorised adjustable lower crosshead with automatic hydraulic frame clamping
- Load transducer (±25kN capacity)

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<td>NCHRP9-19; NCHRP9-29</td>
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<tr>
<th><strong>UNBOUND MATERIALS</strong></th>
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<tr>
<td>Advanced data acquisition system</td>
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<tr>
<td>» 20 bit resolution, 5kHz per channel</td>
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<td>» 1024 data points per cycle</td>
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Servo-Pneumatic Universal Testing Machine  CRT-UTM-NU
Servo-Hydraulic Universal Testing Machine  CRT-UTM-HYD

**SPECIFICATIONS**

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<tr>
<th></th>
<th>CRT-UTM-NU</th>
<th>CRT-UTM-HYD</th>
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<tr>
<td><strong>Maximum Load</strong></td>
<td>Electronically limited to 15.5kN</td>
<td>25kN or 35kN</td>
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<tr>
<td><strong>Load Transducer</strong></td>
<td>±20kN</td>
<td>±25kN or ±50kN</td>
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<tr>
<td><strong>Actuator Stroke</strong></td>
<td>30mm</td>
<td>50mm</td>
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<tr>
<td><strong>Frequency</strong></td>
<td>0 to 30Hz</td>
<td>0 to 70Hz</td>
</tr>
<tr>
<td><strong>Electrical Supply</strong>¹</td>
<td>220-240 Volts 50Hz @ 13A</td>
<td>3 Phase 415 Volts 50 Hz @ 16A</td>
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<tr>
<td><strong>Compressed Air</strong></td>
<td>7-10 bar at 600 L/min</td>
<td>7 bar @ 100 L/min</td>
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<tr>
<td><strong>Dimension mm (WxDxH)</strong></td>
<td>Frame 360 x 400 x 740</td>
<td>Cabinet 1000 x 1300 x 2400</td>
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<tr>
<td></td>
<td>Control Box 360 x 280 x 140</td>
<td>Power Pack 630 x 580 x 890</td>
</tr>
<tr>
<td><strong>Working space required mm (WxDxH)</strong></td>
<td>825 x 1650 x 2100 when fitted in cabinet CRT-TCC</td>
<td>1100 x 2300 x 2600</td>
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<tr>
<td><strong>Estimated Weight Kg</strong></td>
<td>Frame 30</td>
<td>Cabinet 680</td>
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<tr>
<td></td>
<td>Control box 6</td>
<td>Power Pack 60</td>
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<tr>
<td><strong>PC</strong></td>
<td>Required (Please enquire for minimum spec)</td>
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¹ others available upon request

**SOFTWARE**

- User friendly, intuitive and reliable Windows software developed using LabVIEW
- Standard test software available to meet specific EN, ASTM and AASHTO test methods
- Universal test software for the development of test methods using static, sinusoidal, haversine, square, triangular with user selected frequencies and data collection rates
- Stored test data can be imported into a spreadsheet package to be analysed by the user
- Utilities are included for transducer check, diagnostic routines and calibration

**Calibration & Maintenance**

Calibration, Annual Service and Maintenance Contracts are available for this device.
UKAS accreditation to satisfy typed testing as described in EN 13108.
Please enquire for further details.

Note: This device should be checked and calibrated annually.
Accessories

Accessories are not included in the price of the main device and may be purchased separately if required.

**CRT-IT-SET Test System**
Indirect tensile stiffness modulus measurement system to perform EN 12697-26 (Annex C)
- Sub-frame for 100mm and 150mm Ø specimens, Specimen alignment jig
- Loading strips and displacement transducer yoke for 100 & 150mm Ø specimens
- 2* CRT-ITLV AC LVDT displacement transducer ±0.25mm range
- CRT-CALCR. Calibration check ring for checking accuracy of load and displacement transducers used in Indirect Tensile Stiffness Modulus test
- Setup jig
- Crosshead with linear bearings
- 1* 7mm spanner
- Test software to meet latest standard specifications

**CRT-FAT-SET**
Indirect tensile fatigue measurement system to perform EN 12697-24 (Annex E)
- Requires CRT-IT-SET Sub-frame
- 2* CRT-SPTLVDT displacement transducer ±1.0mm range
- On specimen fatigue clamping frame for 100mm Ø specimens
- Setup jig
- 1* 7mm spanner
- Test software to meet latest standard specifications

**CRT-ITSMFAT-SET**
Indirect tensile stiffness modulus and fatigue measurement system to perform EN 12697-26 (Annex C) and EN 12697-24 (Annex E)
- Sub-frame for 100mm and 150mm Ø specimens
- Specimen alignment jig
- Loading strips and displacement transducer yoke for 100 & 150mm Ø specimens
- 2* CRT-ITLV AC LVDT displacement transducer ±0.25mm range
- CRT-CALCR. Calibration check ring for checking accuracy of load and displacement transducers used in Indirect Tensile Stiffness Modulus test
- 2* CRT-SPTLVDT displacement transducer ±1.0mm range
- On specimen fatigue clamping frame for 100mm Ø specimens
- Setup jig
- Crosshead with linear bearings
- 1* 7mm spanner
- Test software to meet latest standard specifications

**CRT-IT-RESMOD**
For AASHTO TP31 and ASTM D4123
- Sub-frame, Loading strips for Ø 101.6 mm and Ø 152.4 mm specimens, 2 * CRT-SPTLVDT displacement transducer ±1.0mm range, 2 * CRT-ITLV AC LVDT. 4*horizontal LVDT adjusters, 2 *vertical LVDT adjusters, LVDT yoke, Test software

**CRT-D7369**
Resilient modulus test system to perform ASTM D7369
For ASTM D7369
- Sub-frame, Loading strips for Ø 101.6 mm and Ø 152.4 mm specimens, 2 * displacement transducer ±1.0mm range, 2 * displacement transducer ±0.25mm range
- 8* Clip-on LVDT holders, 16 * target, Target placer unit, 1* Epoxy adhesive, Test software to perform resilient modulus according to ASTM D7369-09
Accessories (cont)

**CRT-PD-SET**
Dynamic and static creep measurement system to perform EN12697-25 (Method A)
- 1* 100mm platens (top and bottom) with holders
- 1* 150mm platens (top and bottom) with holders
- 2* CRT-PDLV AC LVDT displacement transducer ±5.0mm range
- Test software to meet latest standard specifications

**CRT-T307**
Triaxial system to perform AASHTO T307 on 200mm * Ø100mm specimens of unbound material
- Triaxial cell with internally mounted load cell
- Base adaptor with fluid connections for top platen, bottom platen and cell
- Pressure range 0 – 500kPa
- Pneumatic control system with vacuum, closed loop pressure control and pressure transducer
- 1* Ø100mm top platen
- 1* Ø100mm membrane stretcher
- 2* LVDTs
- 2* Porous end caps for Ø100mm specimens
- 1* Plastic Ø100mm dummy specimen
- 4* O-rings Ø100mm
- 3* Rubber membranes for 200mm x Ø100mm specimens
- Test software

Note: CRT-T307 can be used to perform EN12697-25B on Ø100mm specimens if ordered with steel platens

**CRT-T307+**
Triaxial system to perform AASHTO T307 on 300mm * Ø150mm and 200mm * Ø100mm specimens of unbound material
- Triaxial cell with internally mounted load cell
- Base adaptor with fluid connections for top platen, bottom platen and cell
- Pressure range 0 – 500kPa
- Pneumatic control system with vacuum, closed loop pressure control and pressure transducer
- 1* Ø100mm top platen
- 1* Ø150mm top platen
- 1* Ø100mm membrane stretcher
- 1* Ø150mm membrane stretcher
- 2* LVDTs
- 2* Porous end caps for Ø100mm specimens
- 2* Porous end caps for Ø150mm specimens
- 1* Plastic Ø100mm dummy specimen
- 1* Plastic Ø150mm dummy specimen
- 4* O-rings Ø100mm
- 4* O-rings Ø150mm
- 3* Rubber membranes for 200mm x Ø100mm specimens
- 3* Rubber membranes for 300mm x Ø150mm specimens
- Test software

Note: CRT-T307+ can be used to perform EN12697-25B on Ø100mm and Ø 150mm specimens if ordered with steel platens
CRT-PRESTRIAX-SET
Dynamic and static creep (Flow) measurement system with confining stress to perform EN12697-25 Method B
• Pressure range 0 – 500kPa
• Triaxial cell with internally mounted load cell
• Pneumatic control system with pressure controller and pressure indicator
• 1* Ø100mm perforated hardened polished upper platen
• 1* Ø150mm perforated hardened polished upper platen
• 1* Ø100mm perforated hardened polished lower platen
• 1* Ø150mm perforated hardened polished lower platen
• Platens are M.S. grade 070M20 case hardened to 750HV to a depth after grinding of at least 0.5mm. They are surface ground and polished.
• 2*CRT-PDLV
• 3* Ø100mm neoprene membranes
• 3* Ø150mm neoprene membranes
• Test software
Note: CRT-PRESTRIAX-SET can be used to perform EN12697-25 Method A if a Ø96mm top platen is ordered
Note: Software is also available to perform Flow Time and Flow Number

CRT-SPTLV
Test system to perform dynamic modulus according to AASHTO TP62 / Simple
Performance Test
• 2* Clip-on CRT-SPTLVDT displacement transducer ±1.0mm range
• 4* Clip-on LVDT holders, 24 targets
• LVDT stud placer unit
• LVDT stud placer top plate
• 1* upper platen 100 SPT
• 1* lower platen 100 SPT
• 2* 100mm dia. X 0.5 PTFE disc
• 1* araldite glue
• Pneumatic fittings
• Test software to perform Dynamic modulus for permanent deformation

CRT-UNIVSOFT
Facilitates the design of test routines that can include multiple wave types, test stages and methods of data acquisition

CRT-TCC Temperature controlled cabinet for CRT-UTM-NU
The temperature can be controlled to 0.2°C over the range - 25°C to + 60°C using a P.I.D. digital temperature controller, the CAL3200. Forced air over the heater and cooling fins and through the air duct in the rear wall ensures a uniform temperature throughout the cabinet. Defrost water drains via a pipe on the back of the cabinet to a heated tray underneath the cabinet where the water will evaporate. The cabinet also features an over temperature device which will switch off the fans, heating, cooling and illuminates a warning light if the set temperature is exceeded. The front door is double-glazed and contains a heating element to ensure that the glass door remains clear. When testing asphalt good temperature control is essential. Test data shows that a 1% change in temperature can cause up to 10% variation in stiffness results.

CRT-COMP-650
Standard air compressor (up to 7bar and 600 L/m) for supply of air to CRT-UTM-NU

CRT-FT06-AIRDRYER
Air dryer with 600 L/s flow rate and 3°C dew point