

# 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.

## KEY FEATURES

- Low cost dynamic loading universal test system ideally suited to testing asphalt and unbound granular materials
- Double acting low friction actuator with integral stroke transducer
- Utilises high performance ceramic spool servo-valve
- High quality stainless steel frame
- 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

## TEST METHODS INCLUDE

### ASPHALT

#### Modulus

- EN 12697-26 Annex C
- EN 12697-26 Annex D & E
- ASTM D7369
- ASTM D4123
- ASTM D3497
- AASHTO TP31
- AASHTO TP62 / TP79

#### Permanent Deformation

- EN 12697-25 Methods A & B

#### Fatigue

- EN 12697-24 Annex E
- ASTM D7313 DCT (Disc shaped compact tension test)
- EN 12697-44 SCB (Semi circular bending test)

#### Simple Performance Tests

- Dynamic Modulus; Flow number, Flow time  
NCHRP9-19; NCHRP9-29

### UNBOUND MATERIALS

- AASHTO T307 (previously TP46)
- NCHRP 1-28A

## 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 ( $\pm 20$ kN capacity)

### ADVANCED DATA ACQUISITION SYSTEM\*

- » 20 bit resolution, 5kHz per channel
- » Will accept any voltage transducer in any channel using TEDS Thermocouples
- » 1024 data points per cycle
- » Up to 16 digital input & output channels
- » Ethernet/USB/RS232 to PC communication

\* Available late 2012



# Servo-Pneumatic Universal Testing Machine CRT-UTM-NU

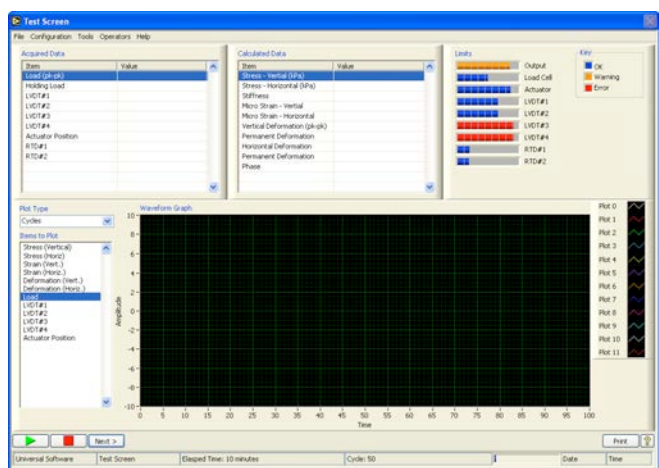
# Servo-Hydraulic Universal Testing Machine CRT-UTM-HYD

SPECIFICATIONS	CRT-UTM-NU	CRT-UTM-HYD
Maximum Load	Electronically limited to 15.5kN	25kN to 110kN
Load Transducer	±20kN	Variable dependant on capacity
Actuator Stroke mm	30	50
Frequency	0 to 30 Hz	0 to 70 Hz
Electrical Supply <sup>1</sup>	220-240 Volts 50 Hz @ 13A	3 Phase 415 Volts 50 Hz @ 16A
Compressed Air	7-10 bar at 600 L/min	7 bar @ 100 L/min
Dimension mm (WxDxH)	Frame 360 x 400 x 740 Control Box 360 x 280 x 140	Cabinet 1000 x 1300 x 2400 Power Pack 630 x 580 x 890 *Please enquire for 110kN machine
Working space required mm (WxDxH)	825 x 1650 x 2100 when fitted in cabinet CRT-TCC	1100 x 2300 x 2600
Estimated Weight Kg	Frame 30 Control box 6	Cabinet 680 Power Pack 60
PC	Included	Included

<sup>1</sup> 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-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 100 mm and 150 mm Ø specimens
- Specimen alignment jig
- Loading strips and displacement transducer yoke for 100 & 150 mm Ø specimens
- 2\* CRT-ITLV AC LVDT displacement transducer  $\pm 0.25$  mm 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  $\pm 1.0$  mm range
- On specimen fatigue clamping frame for 100 mm Ø specimens
- Setup jig
- Crosshead with linear bearings
- 1\* 7mm spanner
- Test software to meet latest standard specifications

\* Can be sold as two separate accessories CRT-IT-SET and CRT-FAT-SET



### CRT-IT-RESMOD

Resilient modulus test system to perform 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  $\pm 1.0$  mm range
- 2 \* CRT-ITLV AC LVDT
- 4\*horizontal LVDT adjusters
- 2 \*vertical LVDT adjusters, LVDT yoke
- Test software to meet latest standard specifications

### CRT-D7369

Resilient modulus test system to perform ASTM D7369

- Sub-frame, Loading strips for Ø 101.6 mm and Ø 152.4 mm specimens,
- 2 \* displacement transducer  $\pm 1.0$  mm range,
- 2 \* displacement transducer  $\pm 0.25$  mm range
- 8\* Clip-on LVDT holders, 16 \* target, Target placer unit,
- 1\* Epoxy adhesive,
- Test software to meet latest standard specifications

### CRT-SPTLV

Test system to perform dynamic modulus according to AASHTO TP62 / Simple Performance Test

- 2\* Clip-on CRT-SPTLVDT displacement transducer  $\pm 1.0$  mm 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-4PT-BB

Test system to perform four point bending beam according to EN 12697-24 Annex D, EN 12697-26 Annex B and AASHTO T321-03 (TP8) to be used on UTM-HYDs Beams from 40 x 40 to 70 x 70 mm cross sections and 400 mm long

## Accessories (cont)



### CRT-PD-SET

Dynamic and static creep measurement system to perform EN12697-25 (Method A) and DD226

- 1\* 100 mm platens (top and bottom) with holders
- 1\* 150 mm platens (top and bottom) with holders
- 2\* CRT-PDLV. AC LVDT displacement transducer  $\pm 5.0$ mm range
- 1\* CRT-INDENT
- Test software to meet latest standard specifications

### 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\*  $\varnothing 100$  mm perforated hardened polished upper platen
- 1\*  $\varnothing 150$  mm perforated hardened polished upper platen
- 1\*  $\varnothing 100$  mm perforated hardened polished lower platen
- 1\*  $\varnothing 150$  mm perforated hardened polished lower platen
- Platens are M.S. grade 070M20 case hardened to 750HV to a depth after grinding of at least 0.5 mm. They are surface ground and polished.
- 2\* CRT-PDLV
- 3\*  $\varnothing 100$  mm neoprene membranes
- 3\*  $\varnothing 150$  mm neoprene membranes
- Test software to meet latest standard specifications

Note: CRT-PRESTRIAX-SET can be used to perform EN12697-25 Method A if a  $\varnothing 96$ mm top platen is ordered

Note: Software is also available to perform Flow Time and Flow Number



### CRT-DTC-UTM14 and CRT-DTC-UTM25

Direct Compression and Tension measurement system to perform EN12697-26 Annexes D&E (DT-CY/CT-PR/DTC-CY) for CRT-UTMs

- Mechanical frame
- 3 x CRT-SPTLV AV LVDT displacement transducers  $\pm 1.0$ mm
- LVDT conditioning card
- LVDT mounting clamp, screw and stud
- 6 x magnets and gluing jig
- 300mm actuator rod for DTC-UTM25 only
- Test software to meet latest standard specifications



### CRT-EN13286-7

Unbound system to perform EN 13286-7 (used only with UTM-HYD)

- CRT-EN13286-7M Mould
- CRT-EN13286-7-MEM Membrane for triaxial cell 150x400mm- Pack of 2

### CRT-UNIVSOFT

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

### 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

### 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\* Ø100 mm top platen, 1\* Ø100 mm membrane stretcher
- 3 \* Rubber membranes for 200 mm x Ø100 mm specimens, 4 \* O-rings Ø100 mm
- 2\* LVDTs
- 2 \* Porous end caps for Ø100 mm specimens
- 1 \* Plastic Ø100 mm dummy specimen
- Test software

Note: CRT-T307 can be used to perform EN12697-25B on Ø100 mm specimens if ordered with steel platens

### CRT-T307+

Triaxial system to perform AASHTO T307 on 300 mm \* Ø150 mm and 200 mm \* Ø100 mm 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\* Ø100 mm top platen
- 1\* Ø150 mm top platen
- 1\* Ø100 mm membrane stretcher
- 1\* Ø150 mm membrane stretcher
- 2\* LVDTs
- 2 \* Porous end caps for Ø100 mm specimens
- 2 \* Porous end caps for Ø150 mm specimens
- 1 \* Plastic Ø100 mm dummy specimen
- 1 \* Plastic Ø150 mm dummy specimen
- 4 \* O-rings Ø100 mm
- 4 \* O-rings Ø150 mm
- 3 \* Rubber membranes for 200 mm x Ø100 mm specimens
- 3 \* Rubber membranes for 300 mm x Ø150 mm 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-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.

