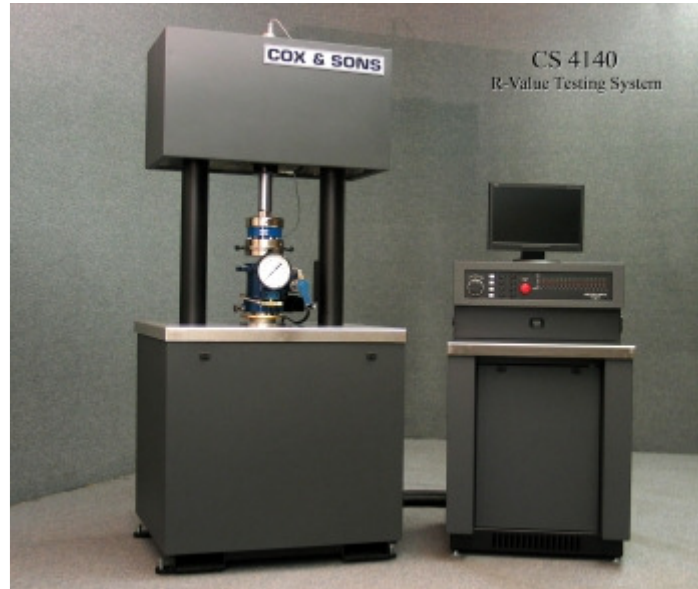


CS4140 AXIAL TESTING SYSTEM



BASIC SYSTEM OVERVIEW

The machine is a versatile, fully automated, single axis, closed-loop hydraulic testing system specifically designed to perform tests on soils and asphalt concrete mixtures over a wide range of stresses and frequencies. The equipment has sufficient flexibility to perform in a variety of environments: university research, special tests or standard tests as required by state DOT's and other government agencies. The design ensures the easiest possible interface with the operating technician.

The system will perform the tests and collect the data with a minimum of user input and knowledge. The testing system will perform the following tests:

- *Dynamic (sine, square and triangular wave)*
- *Creep*
- *Repetitive loading (haversine)*
- *Constant rate (ramp)*
- *Random loading*

- *Custom software templates for standard and special tests that fall within the static and dynamic capabilities of the system are available.*

Features

- compact size – (Floor space required 66 " wide by 41" deep)
- Extremely quiet hydraulic power supply. The pump is enclosed in an acoustically dampened outer cabinet for noise reduction.
- Rigid steel cross heads are machined from 4" thick solid steel billets.
- Heads are supported by two 4.5" dia. steel columns.
- Durable 11 gauge (.125 in.) thick 304 stainless steel console top.
- Totally integrated load frame, hydraulic power supply and control system. The hydraulic hoses, transducer wiring, hydraulic system falls within the confines of the cabinet for easy installation and service, noise reduction and a neat appearance.

The testing system includes the following major components:

CONTROL AND DATA ACQUISITION SYSTEM

- computer system with digital control and data acquisition software
- transducer signal conditioning
- precision power supplies
- hydraulic controls

TEST UNIT

- load frame
- hydraulic actuator
- servo valve
- displacement transducer
- load cell
- hydraulic system

- actuator safety system (manifolds and solenoids)
- gauges

SPECIFICATIONS

CONTROL AND DATA ACQUISITION SYSTEM

The testing system design concept is for high production testing requiring constant operator interface between the control cabinet and testing machine. Monitor, keyboard and controls are positioned at a convenient height to allow the operator to insert specimens, view the monitor and reach the controls with a minimum of effort and movement.

Specifications

- Centerline height of monitor allows convenient viewing while standing or sitting on a drafting stool.
- Table height – 36.5 inches
- Signal conditioning and controls are mounted in two drawers for accessibility from the back of the cabinet.
- A tower-mounted computer is installed in the right side of the control cabinet for easy accessibility and to maximize table space.
- A positive internal air supply is provided to prevent airborne contamination of the computer. A 200-CFM thin muffin fan is installed on the side of the computer and blows through a replaceable, extended surface air filter.

COMPUTER SYSTEM

IBM COMPATIBLE WORKSTATION

- Intel P4 3.0 GHz. CPU
- Intel 845 WN Motherboard with 5 PCI Slots
- 256MB SDRAM
- Geforce2 MX-400 64MB Video

- Western Digital 80GB Hard Drive
 - Teac 1.44MB 3.5in. Floppy Drive
 - 52X CD RW Combo Drive
 - Intel On-Board Sound
 - Logitech Internet Keyboard
 - Logitech Wheel Mouse
 - 4-USB Ports, 1-Parallel, 1-Serial, 2-PS/2
 - Microsoft Windows XP Pro
 - Mid-Tower P4 Case with 300 Watt Power Supply
 - 17" LCD flat screen high resolution monitor
 - National Instruments, multifunction I/O - 16 bit, 16 analog inputs. (PCI bus)
 - Computer Boards 48 digital I/O bits high drive output (64MA sink) PCI bus.
- Control, solid state relays, connector and all internal wiring.

CONTROL AND DATA ACQUISITION SOFTWARE

The software will:

- Control and hydraulic actuator under feedback close loop from any of the input channels acquire data on all channels.
- Monitor channels to provide fail safe limits
- Test data is logged to a spreadsheet file using software timing which provides a time and cycle stamp for each channel collected. Data can be collected on a time or cycle basis which permits collection of only the key data and not extraneous data. The data files are tab-delimited text files therefore the data are viewed and analyzed most easily with a spreadsheet program such as MS Excel. Routines (macros) can easily be written to reduce the spreadsheet data based on any new standards or techniques that are developed.

The software will also:

- Provide monitor displays of the input channels in volts and engineering units.
- Provide scopes to monitor tests
- Include calibration routines

The software has adaptive control capabilities for repetitive tests to minimize effort.

SIGNAL CONDITIONING

Signal conditioners are used for control and data acquisition. The following conditioners will be supplied with the system.

- * CH0 DC conditioner load cell
- * CH1 DC conditioner Axial position

Optional Signal Conditioning for Automatic Stabilometer

The following valve driver is supplied with the system:

- * Servo valve driver Servo actuator

The signal conditioning has an extremely low signal to noise without excessive low-pass filtering for precise, in-phase measurements.

DC SIGNAL CONDITIONING MODULES

Specifications

- Excitation 10VDC
- Variable master gain internal precision 15 turn potentiometer
- Fine gain trim internal 15 turn precision potentiometer

- Gain- software selectable: 1,2,5, and 10 with visual LED indicator for each gain setting
- Zero adjust: internal 15 turn precision potentiometer. Sensitivity changes automatically with each software gain change.
- Auto zero under software control
- Input protection: protected against voltages greater than 15V
- Output impedance: 200 Ω
- Output amplitude: $\pm 10V$
- Adjustable low-pass filter

AC SIGNAL CONDITIONING MODULES

Specifications

- Excitation: 5K or 10KHz jumper selectable. Each channel excitation is slaved to master oscillator.
- Variable master gain: internal precision 15 turn precision potentiometer
- Fine gain trim internal 15 turn precision potentiometer
- Zero adjust: internal 15 turn precision potentiometer. Sensitivity changes automatically with each software gain change.
- Auto zero under software control
- Gain: software selectable: 1,2,5, & 10 with visual LED indicator for each gain setting.
- Input impedance: 10M Ω , differential input
- Common mode rejections: 75dB (0 to 60 Hz)
- Signal to noise ratio: 80dB (10V output)
- Common mode input impedance: 100M Ω

- Input protection: protected against voltages greater than 15V
- Output impedance: 200Ω
- Output amplitude: ±10V
- Output noise: 0.5mVRMS @ max. sensitivity (0.15mVRMS typical)
- Adjustable, low-pass filter
- Excitation amplifier: 3VRMS, 120mA maximum load
- Linearity: 1.01% @ maximum sensitivity.

LOAD FRAME

The frame is designed to withstand fatigue testing at force levels in excess of 200kN. The crossheads are machined from solid 4-inch steel billets to reduce cross head deflection. The upper and lower cross heads are clamped between two, 4.5 inch dia. steel columns to produce high lateral stiffness and precision force train alignment.

HYDRAULIC ACTUATOR

High-frequency servo actuator

- Range – 200kN
- Active stroke - +/- 150 mm
- Piston rod – induction hardened, micro finished and hard chromed plated
- Heavy walled cylinder barrel
- Coaxially mounted feedback transducer
- Rod bearings – Duralon surfaces for low coefficient of friction and wear resistance
- Teflon seals or equivalent for low friction and long life

HIGH PERFORMANCE SERVO VALVE

Moog 760 Series, 2.5 GPM with service manifold Model 760-101A (or equivalent)

Specifications

- * Supply Pressure-
Minimum: 200 psi (14 bar)
Maximum: 3000 psi (210 bar)

- * Proof Pressure-
150% of supply pressure at P port
100% of supply pressure at R port

- * Fluid: Petroleum base hydraulic fluids
60-450 SUS @ 100°F
10-97 cSt @ 38°C

- * Supply Filtration: 25 um absolute or finer

- * Operating Temperature
Minimum: -40°F (-40°C)

Maximum: +275°F (+135°C)
 - Rated Flow Tolerance: $\pm 10\%$
 - Symmetry: $< 10\%$
 - Hysteresis: $< 3\%$
 - Threshold: $< 0.5\%$
 - Null Shift:
 - With temperature 100°F variation $< 2\%$
 - With Acceleration to 10g $< 2\%$
 - With supply pressure 1000-psi change $< 2\%$
 - With return pressure 0 to 500 psi $< 2\%$

LINEAR DISPLACEMENT TRANSDUCERS

Specifications

- Input voltage: $\pm 15\text{V}$ ($\pm 2\%$)
- Displacement: $\pm 75\text{mm}$
- Nonlinearity: $\pm 0.05\%$
- Repeatability: $\pm 0.01\%$
- Transducer temperature coefficient: 10 PPM/ $^{\circ}\text{F}$
- Electronic temperature coefficient: 55 PPM/ $^{\circ}\text{F}$
- Output: $\pm 10\text{V DC}$

UNIVERSAL FATIGUE-RATED LOAD CELL

Specification (Axial)

- Range – 200kN
- Output mV/V: 2mV
- Static error band \pm % rated output: 0.05
- Nonlinearity % full scale: 0.05
- Hysteresis % full scale: 0.03
- Non repeatability % full scale: 0.02
- Tension and compression symmetry \pm full scale: 0.1
- Compensated temperature range $^{\circ}\text{F}$: 0° to $+150^{\circ}$
- Temperature effect on zero % full scale/ 100°F : 0.08
- Temperature effect on sensitivity % reading/ 100°F : 0.08
- Safe overload % rated range: 300
- Optional 200 kN available

HYDRAULIC SYSTEM

The hydraulic power supply is of modular construction with all components integral to the reservoir. All components in the hydraulic system meet or exceed JIC standards.

Specifications

- The hydraulic power supply is located within the load frame cabinet which has access doors on each side for easy adjustments and maintenance. The inside walls have acoustical dampening to ensure quiet system performance.
- 5 HP 3 phase 208/230/380 volts, 50/60 Hz
- Front panel control for high or low pressure
- Low noise level pressure and flow compensated hydraulic pump
- Oversize air-cooled heat exchanger
- 3 micron high-pressure oil filtration
- 25 micron return oil filtration
- Pressure and return line accumulators for hydraulic servo valve
- Oil filled pressure gauge
- Over temperature limit switch
- Low oil level limit switch

ACTUATOR SAFETY SYSTEM

A system emergency stop push-button switch will override all operating modes and perform the following functions:

- Immediately stop actuator movement
- Reduce actuator supply pressure to zero for testing fixture protection
- Turn on red indicator light

