

# Fatigue Master 7000

## Digital Load Control System



Sophisticated hardware and software techniques used throughout the system satisfy a wide variety of testing applications, ranging from simple static loading to large scale fatigue type testing.

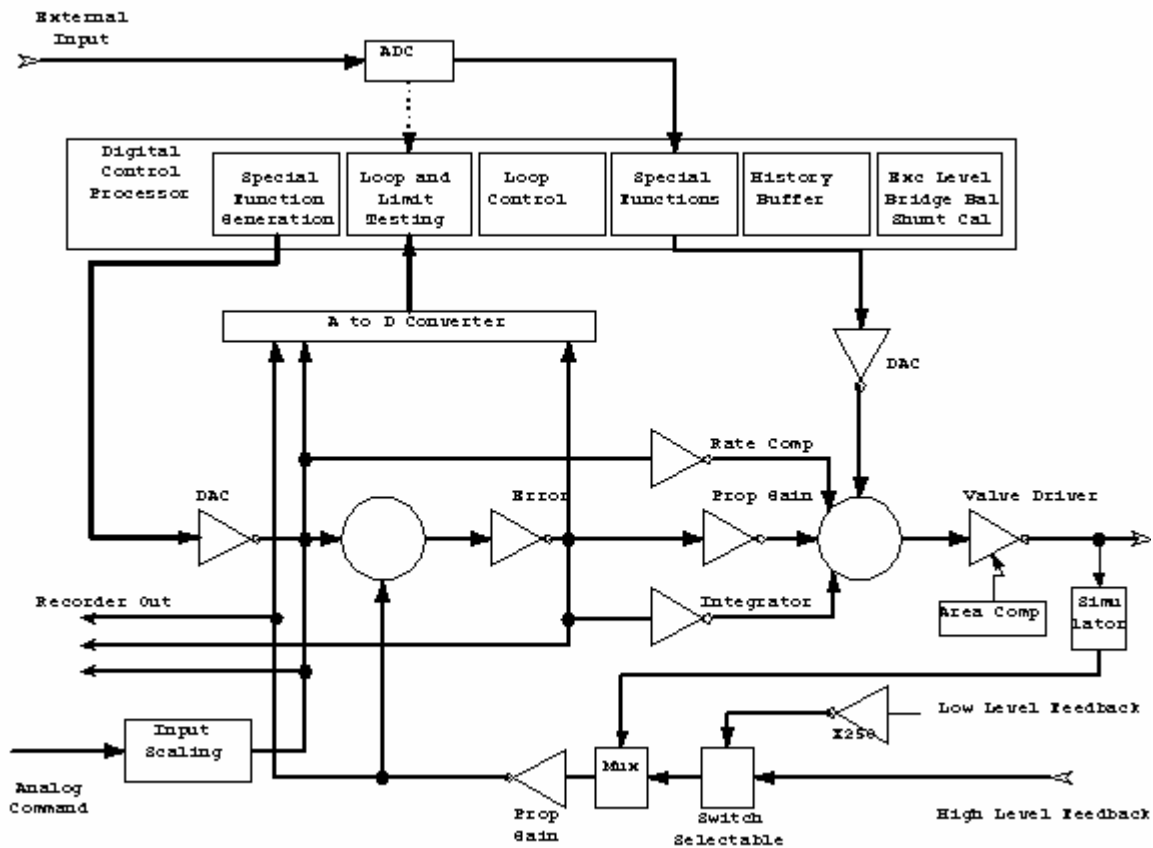
In fact, Kinetic's Cyber System Fatigue Master 7000 offers flexibility and expansion capabilities that allow the users to meet immediate, as well as future testing requirements.

### SYSTEM FEATURES

- Centralized Control & Monitoring
- Powerful 32-Bit Host Processor
- Multiple Independent Tests
- Hybrid Servo Controllers (Digital/Analog)
- Supports up to 256 Control Channels
- Random Channel Assignment
- Supports Manually-Entered Spectrum
- Supports Externally-Entered Spectrum
- Communication Networking (Ethernet)
- High Level "C" Language Software
- Spread-Sheet Oriented Test Setup
- PC Interface available
- Continuous Auto-Tuning of Loop Parameters
- Interactive Test Control Panel
- Internal Function Generation \* Graphical Data Representation
- Economical Expansion
- Aux Data Acquisition and/or Interfacing

## Cyber System FM7000 Performance Specifications

Command Input Scaling	0 to 100% Full-Scale
Command Input Signal Type	Analog or Digital
Command Input Polarity	Positive or Negative
Static Offset Range (Setpoint)	+100% to -100% Full-Scale
Open Loop Bandwidth	1KHz +/- 1dB (w/o Rate Comp)
Rate Compensation	0.5Hz to 100Hz
Feedback Gain	2 ranges: - X1 to X40 - X250 to X10,000
Proportional Gain	X0.03 to X128 in 4096 Steps
Integration Time Constant	0.1 Seconds to 10 Seconds
Dither Signal	0 to 20% of Full-Scale @400Hz
Loop Update Rate	1,200Hz



## Feedback Amplifier Specifications

Full-Scale Input Range	1 to +/-40mV in 4,096 steps 0.25V to +/-10V in 4,096 steps
Auto Bridge Balance	+/-2mV/volt in 4,096 steps
Offset Stability	<1uV/deg C
Bandwidth	110 dB
Amplifier Non-Linearity	0.01%
Input Impedance	100 megohms

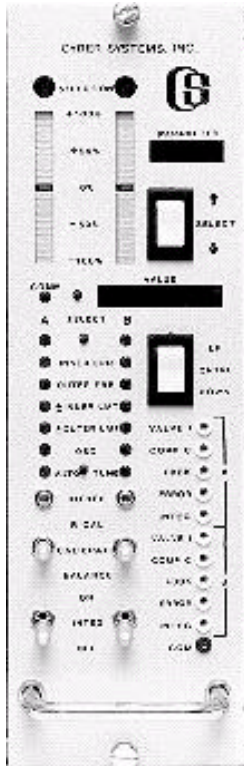
## Signal Conditioning Specifications

Wiring Standard	Western Regional Strain Gage (10, 8, 6, or 4-wire configuration)
Excitation Voltage	0 to 15 volts in 4,096 steps
Output Stability	50 parts per million per deg C
Output Current	60 mA
Line Regulation	0.005%
Load Regulation	0.02%
RMS Noise	0.1 mV
Fault Trigger	2 volts

## Limit Detection Levels

+/- Inner Feedback Limit	0 to +/-102.4% of Full-Scale
+/- Outer Feedback Limit	0 to +/-102.4% of Full-Scale
Inner Loop-Error Limit	0 to 100% of Full-Scale
Outer Loop-Error Limit	0 to 100% of Full-Scale
Endpoint Pacing	System Function
Inner-Error Pacing	System Function
Oscillation Detection	1 to 10 sign reversals

## Kinetic's Cyber Model 7030 Servo Controller



- Front Panel Controls & Monitoring
- Remote Setup
- Operational in Stand-Alone Configuration
- Adaptive Self-Tuning
- Automatic Bridge Balancing
- Automatic Feedback Scaling
- Automatic Valve Balancing
- Oscillation Protection
- \* Four Levels of Error Detection
- Dynamic Null Pacing
- Endpoint Tolerance Checking
- Built in Hydraulic Simulation

Kinetic Systems has evaluated the many requirements of the testing industry and has concluded that in cases where a versatile instrument is required that can provide high-speed adaptive loop control, with the reliability of proven analog circuitry, a combination of analog and digital techniques should be used. Kinetic's Cyber Model 7030 Digital Servo Controller takes advantage of the latest digital, analog, and software techniques available today. Built-in digital function generation is combined with analog loop closure circuitry, where the PID functions are part of the analog loop, but can be digitally enhanced through software control. A built-in 680X0 microprocessor is dedicated to monitor the control process, fine tuning all of the PID parameters for each actuator, much as a well trained operator manually fine tunes an older system... only more accurately.

Kinetic's hybrid design provides better performance than an "all digital" controller for two important reasons.

First, "all digital" controllers introduce an additional pole in the control loop due to the required sampling process. This pole creates additional phase shift which limits the maximum gain before oscillation occurs. Hybrid controllers on the other hand, have less phase-shift; allowing higher gain and better loop performance.

Secondly, with "all digital" controllers, digital reproduction leads to increased granularity of the loop signals, ultimately resulting in insufficient ADC resolution.

Hence, Kinetic's hybrid design offers the best of both worlds...the higher performance of an analog loop with auto-tuning, anti-oscillation protection, and Bode estimation, combined with the flexibility of an "all digital" controller.";

## **Cyber System FM7000 Load Control System Architecture**

A contemporary 32-bit Motorola VME host processor, running the UNIX Operating System, is dedicated to performing various no-critical test functions, including setup and monitoring of test data. System operation is simplified with "user-friendly", menu driven software and Video Display Terminals.

Once a test has been defined, the test procedure and individual channel parameters are downloaded to Cyber's Target Computer and digital servo controllers, respectively. This data transfer is accomplished using industry standard high-speed communication interfaces.

The Target Computer takes on the real-time task of managing the test procedure, executing each step as defined during setup. Continuous communication with each servo controller and test control panel provides the Target with test data which is used to determine whether or not individual channel limits have been exceeded. Upon exceeding these limits, the system can invoke various user-defined cautionary or safety procedures, ensuring test article integrity at all times.

On-Line display and recording of test status and other related data is available at the Host Computer for monitoring and hardcopy purposes. Optional features such as real-time graphics, PC Interface, and Auxiliary Data Acquisition are also available.

## Cyber System FM7000 Interface

The Operational aspects of the **FM7000** are simplified through a contemporary user-friendly software interfaces. Pull-down menus and spreadsheets allow users with no prior knowledge of computers to operate each system function with ease.

The FM7000 Unix Interface makes setting up and monitoring a test a snap. Intuitive Pull-down menus and Spreadsheets allow easy access to all aspects of Test Definition and Control.

The FM7000 Real-Time Graphics package provides additional monitoring capabilities through on-line graphical displays, including scrolling strip charts, bar graphs, and tabular readouts. Systems configured with auxiliary data acquisition offer strain vrs stress plots (X-Y graphs).

A PC based interface called **LCS Net** is also available to communicate with and control the FM7000 through an Ethernet connection. The software package brings all the functionality of windows to the Unix based FM7000

Combine the Real-Time processing power of Unix with the ease of use in Windows. This integrated software package communicates to the FM7000 through an Ethernet connection. Perform setup and run tests from a PC. Unique and innovative displays and graphs highlight and organize test data better than ever before.

