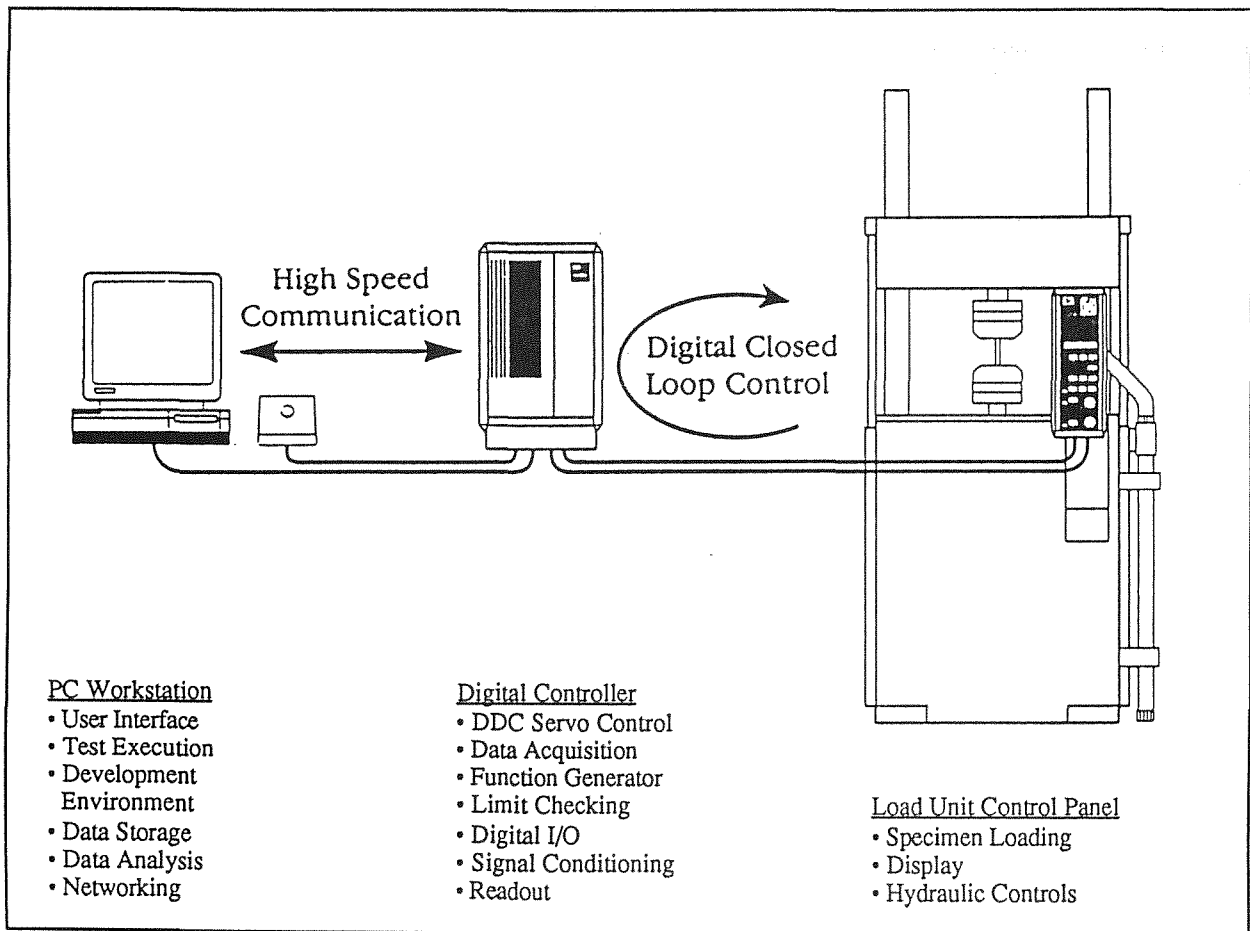


**TESTSTAR - THE MATERIALS TESTING WORKSTATION  
A NEW VERSATILE, HIGH PERFORMANCE, MULTIPROCESSING  
CONTROLLER FOR SERVOHYDRAULIC SYSTEMS**

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**Abstract.** Ever Since MTS developed their first servo-hydraulic test system over 25 years ago, the company has been on the forefront of advanced testing technology. Even more important has been MTS' leadership in applying that technology to provide testing solutions which benefit material testing customers around the world. Today MTS presents the latest development in materials testing: The TestStar Materials Testing Workstation with a unique user interface based on parallel processing and high performance transputer technology.



Picture 1: System Overview

## 1. INTRODUCTION

The challenge in today's rapidly changing world is to continue to be able to satisfy changing testing requirements. The need for using new materials or using existing materials in new ways means the types of tests may vary quickly. To be productive, a test system must easily adapt to new requirements whether it is a test that conforms to national standards or a completely new test, unique to a specific lab. It is crucial that the test system and - more importantly - the controls system does not limit the types of tests that can be done, the way in which data is analysed, or how the information about the materials and components being characterized is communicated. TestStar is MTS' solution to this need for a flexible controls system.

High quality data requires high performance and best resolution. MTS' answer is the step into parallel processing using transputer technology in order to distribute the different controller tasks onto numerous processors. Only this design allows optimum use of hardware and provides system performance that satisfies the most challenging test requirements.

## 2. SYSTEM OVERVIEW

A TestStar system can be functionally broken down into three major parts. The system software running on a personal computer, the digital controller and the load unit control panel. More interesting features are incorporated in the application software. The most flexible package is discussed at the end of this paper.

### System Software

The TestStar system software incorporates MTS' new philosophy: The workstation concept for materials testing. For test preparation, execution and analysis,

the interaction with the test happens through the computer screen, using the graphical user interface and a mouse. MTS has fully integrated the PC into the workstation control system. The result is that material testing is completely software driven.

Controls are operated intuitively, and application test programs or user developed programs can have complete control over the system. Improvements in capabilities, like advances in control algorithms, or additional features, like application specific enhancements, can be implemented on the system by simply loading software updates from a floppy disk. However, even today's TestStar base configuration already includes features like multiple data displays and on-screen digital oscilloscope which are expensive peripheral equipment if they have to be bought separately.

A multi-tasking operating system is utilized to allow access by the user to all servocontroller functions while an application program is executing. The operating system used with TestStar is IBM OS/2 which was selected because it maintains commonality to MS-DOS and even allows MS-DOS applications to execute in the DOS compatibility box under OS/2. IBM has announced further enhancements to OS/2 which will allow the user to execute OS/2, DOS and Windows tasks in parallel.

The user interface to the test system is implemented in software based on OS/2 Presentation Manager. This provides a graphical point and click environment identical to MS-Windows which users become familiar with very quickly. At the same time, the problems associated with the memory limitations and the single tasking nature of MS-DOS are overcome with the OS/2 virtual memory operating system.

### TestStar Controller

High speed, closed loop servo control is completely managed by the digital controller. It contains signal conditioning and data acquisition modules which are closely coupled and carefully shielded from electromagnetic interference from the load unit and other sources.

The TestStar controller incorporates a distributed multiprocessor design. The processor family is the Inmos transputer, a high performance floating point processor. Transputers are unique in that each processor chip has four high speed serial links built into hardware that may be configured to transmit and receive data at speeds up to 20 million bits per second. TestStar utilizes eleven transputers connected in a tightly coupled network. Each hardware subsystem in the TestStar controller is supervised by one or more transputers.

The transputer processors perform 32 bit floating point arithmetics. Therefore, TestStar internally runs completely with engineering units. This eliminates round off errors and algorithm computational noise problems inherent in integer based machines.

All internal communication in TestStar is handled via transputer links at 20 million bits per second. There is no processor bus in the TestStar controller. The backplane in the system is only for power distribution and input/output connections throughout the system. The elimination of the processor bus has significant advantages. The transputer system is more reliable, less costly to repair if failure should occur and no system software time is wasted for managing bus transactions.

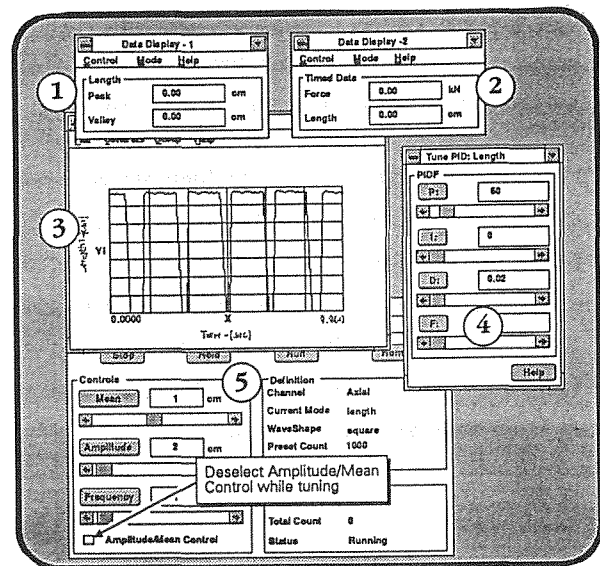
### Load Unit Control Panel

The Load Unit Control Panel simplifies specimen loading. Its convenient location at the load frame makes

it easy to operate the hydraulic controls, move the actuator for specimen setup, and to start and stop tests.

In addition, the LUCP has a bright 40 characters by 16 lines display panel and four softkeys that are used by the application software or by default are assigned to change readout parameters or are used to zero transducers. The LUCP communicates with the rest of the system via a transputer link.

An emergency stop button is located on the LUCP for safety reasons.



Picture 2: Example for use of the Controller Interface

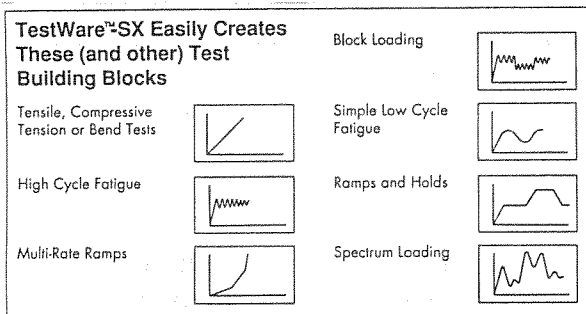
### 3. TESTSTAR SOFTWARE

Each TestStar system comes standard with the following software.

- Controller Interface. The menus and windows that allow to set up and display information from the digital controller.

- Software Function Generator. An on-screen function generator that is set up quickly and allows to run simple tests.
- System Utilities. Used to configure the system, calibrate sensors, check hardware operation, control user access to the TestStar system.
- Programming Libraries. A set of libraries for programming the system using high level programming languages.
- TestWare-SX. The solution for changing test requirements.

With TestWare-SX, programming can be avoided for almost all user defined test requirements in materials testing. Besides TestWare-SX, application programs based on current standards including data analysis are available.



Picture 3: Use of TestWare-SX

#### 4. TESTWARE-SX

TestWare-SX is an exceptionally powerful and easy to use general purpose application software package for materials testing. It is designed to provide machine control, function generation and data acquisition for monotonic, dynamic or multiaxial tests by means of user-defined test procedures. This well-documented package allows the user to create and save his own "templates", i.e., sequences of test command, data acquisition, and machine control tasks, without writing any code. Data from the test is stored in a standard format, allowing transfer of data files to a favorite spreadsheet for analysis, plotting and reporting.