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Instron
Model 8500 PLUS
Dynamic Testing System

Reference Manual

INSTRON

General Safety Precautions

Materials testing systems are potentially hazardous.

Materials testing involves inherent hazards from high forces, rapid motions and stored energy. You must be aware of all moving and operating components which are potentially hazardous, particularly the actuator in a servohydraulic testing system or the moving crosshead in an electromechanical testing system.

Always be fully aware of the possible hazards involved when operating and maintaining these systems. You must not operate any materials testing equipment unless you are thoroughly familiar with its function and operation. Unfamiliarity with a materials testing system can lead to unexpected actuator or crosshead motion with the consequent risk of injury and damage.

Carefully read all relevant manuals and observe all WARNINGS and CAUTIONS. The term WARNING is used where a hazard may lead to injury or death. The term CAUTION is used where a hazard may lead to damage to equipment or to loss of data.

Ensure that the test set-up to be followed and the actual test to be performed on materials, assemblies or structures constitutes no hazard to operating personnel.

Make full use of all mechanical and electronic limits features. These are supplied for your safety to enable you to prevent movement of the actuator piston beyond desired regions of operation.

The following pages detail various general warnings that you must heed at all times while using materials testing equipment. More specific warnings and cautions

willbe found in the text whenever your attention needs to be drawn to a potential hazard.

Your best safety precautions are to gain a thorough understanding of the equipment by reading your instruction manuals and to always use good judgment.

Warning

Disconnect the electrical power supply before removing the covers to electrical equipment.

You must disconnect the equipment from the electrical power supply before removing any electrical safety covers or replacing fuses. Do not reconnect the main power source while the covers are removed unless you are specifically instructed to do so in the manual. Refit covers as soon as possible.

Disconnect power supplies before removing the covers to rotating machinery.

You must disconnect the equipment from all power supplies before removing any cover which gives access to rotating machinery, e.g. belts, screws or shafts. Do not reconnect any power supply while the covers are removed unless you are specifically instructed to do so in the manual. If the equipment needs to be operated to perform maintenance tasks with the covers removed, ensure that all loose clothing, long hair, etc. is tied back. Refit covers as soon as possible.

Warning

Shut down the hydraulic power supply and discharge hydraulic pressure before disconnecting any hydraulic fluid coupling.

Do not disconnect any hydraulic coupling without first shutting down the hydraulic power supply and discharging stored pressure to zero. Tie down or otherwise secure all pressurized hoses to prevent movement during system operation and to prevent the hose from whipping about in the event of a rupture.

Shut off the supply of compressed gas and discharge residual gas pressure before disconnecting any compressed gas coupling

Do not release gas connections without first disconnecting the gas supply and discharging any residual pressure to zero.

Warning

Use protective shields or screens if any possibility exists of a hazard from the failure of a specimen, assembly or structure under test.

Protective shields should be used whenever a risk of injury to operators and observers exists from the failure of a test specimen, assembly or structure, particularly where explosive disintegration may occur. Due to the wide range of specimen materials, assemblies or structures that may be tested using materials testing equipment, any hazard resulting from the failure of a test specimen, assembly or structure is entirely the responsibility of the owner and the user of the equipment.

Protect electrical cables from damage and inadvertent disconnection.

The sudden loss of controlling and feedback signals which can result from a disconnected or damaged cable causes an open loop condition which may drive the actuator or crosshead rapidly to its extremes of motion. All electrical cables, particularly transducer cables, must be protected from damage. Never route cables across the floor without protection, nor suspend cables overhead under excessive strain. Use padding to avoid chafing where cables are routed around corners or through wall openings.

Warning

Wear protective clothing when handling equipment at extremes of temperature.

Materials testing is often carried out at non-ambient temperatures using ovens, furnaces or cryogenic chambers. Extreme temperature means an operating temperature exceeding 60°C (140°F) or below 0°C (32°F). You must use protective clothing, such as gloves, when handling equipment at these temperatures. A warning notice concerning low or high temperature operation must be displayed whenever temperature control equipment is in use. You should note that the hazard from extreme temperature can extend beyond the immediate area of the test.

Take care when installing or removing a specimen, assembly or structure.

Installation or removal of a specimen, assembly or structure involves working inside the hazard area between the grips or fixtures. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.

Warning

Do not place a testing system off-line from computer control without first ensuring that no actuator or crosshead movement will occur upon transfer to manual control.

The actuator or crosshead will immediately respond to manual control settings when the system is placed off-line from computer control. Before transferring to manual control, make sure that the control settings are such that unexpected actuator or crosshead movement cannot occur.

Keep clear of the operating envelope of a robotic device unless the device is de-activated.

The robot in an automated testing system presents a hazard because its movements are hard to predict. The robot can go instantly from a waiting state to high speed operation in several axes of motion. During system operation , keep away from the operating envelope of the robot. Deactivate the robot before entering the envelope for any purpose, such as reloading the specimen magazine.

Table of Contents

Chapter Page

Chapter 1 Introduction

Outline 1-1
Introduction 1-2
Model 8500 - What It Is And What It Does 1-6
Analog versus Digital Control 1-8
Analog Testing Systems 1-8
Digital Testing Systems 1-9
About This Manual 1-12

Chapter 2 Functional Description

Outline 2-1
Introduction 2-2
System Component Interactions 2-3
Tower Console 2-7
Master Dynamic Controller Card 2-12
Sensor Conditioner Cards 2-14
Low Level Input 2-14
High Level Input 2-18
Transducer Recognition 2-19

Chapter 3 Command Generation

Outline 3-1
Composite Command 3-2
Set Point 3-3
Definition 3-3
Changing Set Point 3-3
Explicitly 3-3
Jog Buttons 3-4

Table of Contents (continued)

Chapter **Page**

Chapter 3 Command Generation (continued)
Controller Transitions 3-4
Ramp Waveforms 3-4
Random Waveforms 3-5
Cyclic Waveforms 3-6
Cyclic Waveform Generation 3-6
Cyclic Waveform Generator States 3-7
Controlling the Waveform Generator States 3-8
Waveform Generator State Diagram 3-9
Argument Generation 3-10
Shape Generation 3-11
Sine Function Generation 3-11
Triangle Function Generation 3-12
Square Function Generation 3-12
Haver Function Generation 3-13
External Waveforms 3-13
Amplitude Scaling 3-15
Accuracy and Resolution 3-15
Sine Wave Accuracy 3-15
Sine Wave Resolution 3-16
Triangle Accuracy and Resolution 3-16
Frequency Accuracy 3-16
Ramp Waveforms 3-18
Ramp Generator States 3-18
Ramp Generation 3-20
Description of Generation 3-24

Table of Contents (continued)

Chapter **Page**

Chapter 3 Command Generation (continued)
Ramp Rate Conversion Accuracy and Resolution....3-25
Slowest and Fastest Ramp Speeds....3-26
Absolute Ramp Waveforms....3-27
Random Waveforms....3-30
Random Waveform Generator States....3-30
Random Waveform Generation....3-31
Random Waveform Generator Buffers....3-33
Demand Hold....3-35
Demand Hold Dynamic Considerations...3-36
Sampled Data Playback....3-38
Interpolator....3-40
Filter....3-41
Amplitude Scaling and Envelope....3-41
Accuracy and Resolution....3-42
Constant Amplitude Control....3-44
How Constant Amplitude Works....3-44
Performance....3-45
Constant Setpoint Control....3-47

Chapter 4 Feedback Processing
Outline....4-1
Transducer Recognition....4-2
Calibration Process....4-5
Manual Calibration....4-5
Electrical Span Calibration....4-6
Auto Calibration....4-7

Table of Contents (continued)

Chapter **Page**

Chapter 4 Feedback Processing (continued)

Rebalancing....4-7
Restoring Stored Values....4-8
Auto-Ranging....4-9
Realtime Automatic Ranging....4-9
How Auto-Ranging Works....4-9
Using Zero Suppression....4-11
Zero Suppression Described....4-11
Methods of Zero Suppression....4-13
Peak Detection Algorithm....4-16
Saturation Detection....4-18
Derived Feedback....4-19
Derived Stress and Strain....4-19
True Strain....4-20
True Stress....4-20

Chapter 5 Closing the Loop

Outline....5-1
Introduction....5-2
The Loop Controller....5-4
Description....5-4
Proportional Gain....5-5
Integral Gain....5-6
Derivative Gain....5-7
Lag Term....5-7
Valve Drive Limiting....5-9
Dither Generation....5-9
Loop Shaping....5-11

Table of Contents (continued)

Chapter **Page**

Chapter 5 Closing the Loop (continued)
Manual Loop Shaping....5-11
Auto-Tuning....5-12

Chapter 6 Adaptive Loop Control
Outline....6-1
Introduction....6-2
The Need for Adaptive Control....6-2
Advantages of Adaptive Control....6-4
The Instron Adaptive Controller....6-6
Obtaining the Start-up Parameters....6-8
Start-Up Commissioning....6-8
Auto-Tuning....6-9
Ensuring Accurate Stiffness Estimates....6-11
Enabling/Disabling Adaptive Control....6-13
Summary....6-14

Chapter 7 Limits and Event Detectors
Outline....7-1
Use Of Limits And Event Detectors....7-2
Limits 7-4
Defining a Limit....7-4
Limit Level....7-5
Limit Actions....7-5
Limit Action Priorities....7-7
Limit Monitoring....7-8
Command Execution on Limit Trip....7-9
Limits and Zero Suppression....7-10

Table of Contents (continued)

Chapter **Page**

Chapter 7 Limits and Event Detectors (continued)
Limit Lock 7-10
Limits and the Computer 7-10
Event Detectors 7-12
Event Detector Types 7-12
Threshold 7-13
Peak 7-17
Increment 7-17
Break 7-18
Count 7-20
Enhanced Count 7-21
Digital 7-21
Error 7-22
GPIB Trigger 7-22
System Bus 7-23
Event Detector Access 7-23
Event Detector Actions 7-26
Realtime Actions 7-26
Data Logging Actions 7-28
Event Detector States 7-28
Status Change Messages 7-31
Programmable Event Detector Command Buffers 7-32
Programming Event Detectors with the Model 8500 Command Set 7-32
Command Format 7-33
Resetting the ED State 7-33
Setting the Event Detector Type 7-34

Table of Contents (continued)

Chapter Page

Chapter 7 **Limits and Event Detectors** (continued)
Setting the Event Detector Sign.....7-35
Setting the Event Detector Threshold 7-35
Setting the Event Detector Action 7-35
Setting the Event Detector Data Log Action.....7-36
Activating the Event Detector.....7-36

Chapter 8 **User State Storage**
Outline 8-1
Description 8-2
Parameter Defaults.....8-3

Chapter 9 **System Hardware**
Outline 9-1
Corporate Manifold and the Docile Mode.....9-2
Introduction 9-2
Hydraulic Schematic of the Corporate Manifold.....9-2
Action of the Model 8500 Control Panel.....9-7
Shorting the Servovalve with the Corporate Manifold.....9-8
Setting up the Docile Mode 9-8
Introduction 9-8
When the Standard Docile Mode Set-up Procedure Does Not Work.....9-9
Principle For Table-mounted Actuators 9-10

Table of Contents (continued)

Chapter **Page**

Chapter 9 System Hardware (continued)
Checking If There Is A Problem 9-10
Step-by-Step Procedure 9-11
Dual Servovalve Manifolds 9-15
Crosshead Mounted Actuators 9-15
Use With Non-corporate Manifolds 9-16
Example On Model 8501 With Grips.....9-17
Analog Monitor Outputs 9-19
Board Swapping Hints 9-21
Master Dynamic Controller Board.....9-21
Sensor Conditioner Board.....9-22

Chapter 10 Multi-Axial Systems
Outline 10-1
Introduction 10-2
Command Synchronization.....10-3
Cyclic Waveform Generator.....10-3
Ramp Generator 10-4
Cross Compensation 10-5
An Example of Using Cross-Compensation....10-5
Table of Cross-Compensation Applications...10-8

Appendix A Choosing Code Resistors
Outline A-1
Choosing Calibration And Recognition Code Resistors.....A-2

Table of Contents (continued)

Chapter **Page**

Appendix A Choosing Code Resistors

Schematic of the Instron Transducer Connector A-2
Choosing the Shunt Calibration Resistor A-3
Calibrating to a Known Sensitivity A-4
Calibrating to a Known Strain, Four Active Elements A-5
Calibrating to a Known Strain, Two Active Elements A-6
Calibrating to a Known Strain, One Active Element A-7
Examples A-8
Calibration Resistor Type A-9
Choosing the Recognition Resistor - Theory A-10
Significance of the Code Values A-11
Excitation Level A-11
Sensitivity Setting A-11
Calibration Type A-12
Serial Code A-12
Table of Model 8500 Code Values A-13
Instron Calibration Service A-16

Appendix B Use of Event Detectors

Outline B-1
Test Definition B-2
Analyzing the Test Requirements B-3
Identification of Transition Points B-3

Table of Contents (continued)

Chapter **Page**

Appendix B Use of Event Detectors (continued)
Transition 1 Event Detector B-3
Data Logging B-4
Transition 2 Event Detector B-4
Final Choices B-5
Summary B-5
Setting Up The Test B-7
Test Results B-11
Test Modification B-15

Appendix C Digital Data Resolution
Outline C-1
Introduction C-2
Data Resolution Issues For Digital Control C-4
Finding the Maximum Affordable A/D Converter Resolution C-4
Finding a Limit on Usable Resolution C-4
Comparing Converter Resolution to Usable Resolution C-5
Increasing The Effective Resolution Of The Converter C-6
How Analog Ranging Increases Effective Resolution C-6
Disadvantages Of Fixed Analog Ranging C-9
Realtime Automatic Ranging C-9
Advantages of Automatic Ranging C-9
How Auto-Ranging Works C-10

Table of Contents (continued)

Chapter **Page**

Appendix C Digital Data Resolution (continued)
Demonstrating the Effectiveness of Auto-Ranging C-11
Conclusion C-12

Appendix D Glossary
Outline D-1

List of Illustrations

Figure		Page
1-1.	Typical Analog Testing System	1-9
1-2.	Digital Control Loop Block Diagram	1-10
2-1.	System Functional Block Diagram	2-5
2-2.	Tower Console Functional Block Diagram	2-9
2-3.	MDC Board Functional Block Diagram	2-12
2-4.	Sensor Conditioner Functional Block Diagram	2-15
3-1.	Composite Command Signal Generation	3-2
3-2.	Function Generation	3-6
3-3.	Waveform Generator Diagram	3-7
3-4.	Waveform Generation State Diagram	3-9
3-5.	Waveform Generator with External Waveform Input	3-14
3-6.	Ramp Generator Waveform States	3-19
3-7.	Single Ramp Waveform	3-21
3-8.	Effect of RESET on Ramp Waveform	3-22
3-9.	Effect of FINISH on Ramp Waveform	3-22
3-10.	Dual Ramp Waveform	3-23
3-11.	Trapezoidal Waveform	3-24
3-12.	Absolute Ramp Waveforms	3-29
3-13.	Random Waveform Generator State Diagram	3-30
3-14.	Random Waveforms	3-31
3-15.	Demand-Hold Diagram	3-36
3-16.	Sampled Data Playback Block Diagram	3-39
3-17.	Constant Amplitude Controller	3-45

List of Illustrations (continued)

Figure **Page**

3-18. Constant Setpoint Control Block Diagram....3-48

5-1. Loop Control Block Diagram 5-3
5-2. Effects of Loop Shaping Adjustments 5-13

6-1. Sensitivity to Specimen Stiffness in Load Control 6-3
6-2. Instability in Strain Control at Specimen Yield.....6-4
6-3. Adaptive Control Block Diagram.....6-7

7–1. Event Detector Transition.....7-14
7–2. Mean Signal Input Update.....7-15
7–3. Amplitude Signal Update.....7-16
7–4. Maximum and Minimum Underpeaks 7-16
7–5. Incremental Event Detector 7-19
7–6. Break Event Detector Operation 7-20
7–7. Digital Line Event Detector Action.....7-22
7–8. Event Detector Access.....7-25
7-9. Complete Event Detector State Diagram 7-30

9-1. Manifold Schematic Diagram 9-3
9-2. Example of Docile Mode Stall Force vs. Limit Setting 9-17

10-1. Multi-Axial Cyclic Waveform Generator 10-4

A-2. Transducer Connector Schematic.....A-3

List of Illustrations (continued)

Figure **Page**

B-1. Test Example Load-Strain Curve B-11
B-2. Strain Rate Acceleration B-12
B-3. Expanded View of Load-Strain Curve B-13
B-4. Plot Showing Capture of Last Cycle B-17
B-5. Hysteresis Plot of Last Cycle B-18

C-1. Digital Load Data at Times 1 Range C-7
C-2. Digital Load Data at Times 8 Range C-7
C-3. Digital Load Data at Times 32 Range C-8

List of Tables

Table **Page**

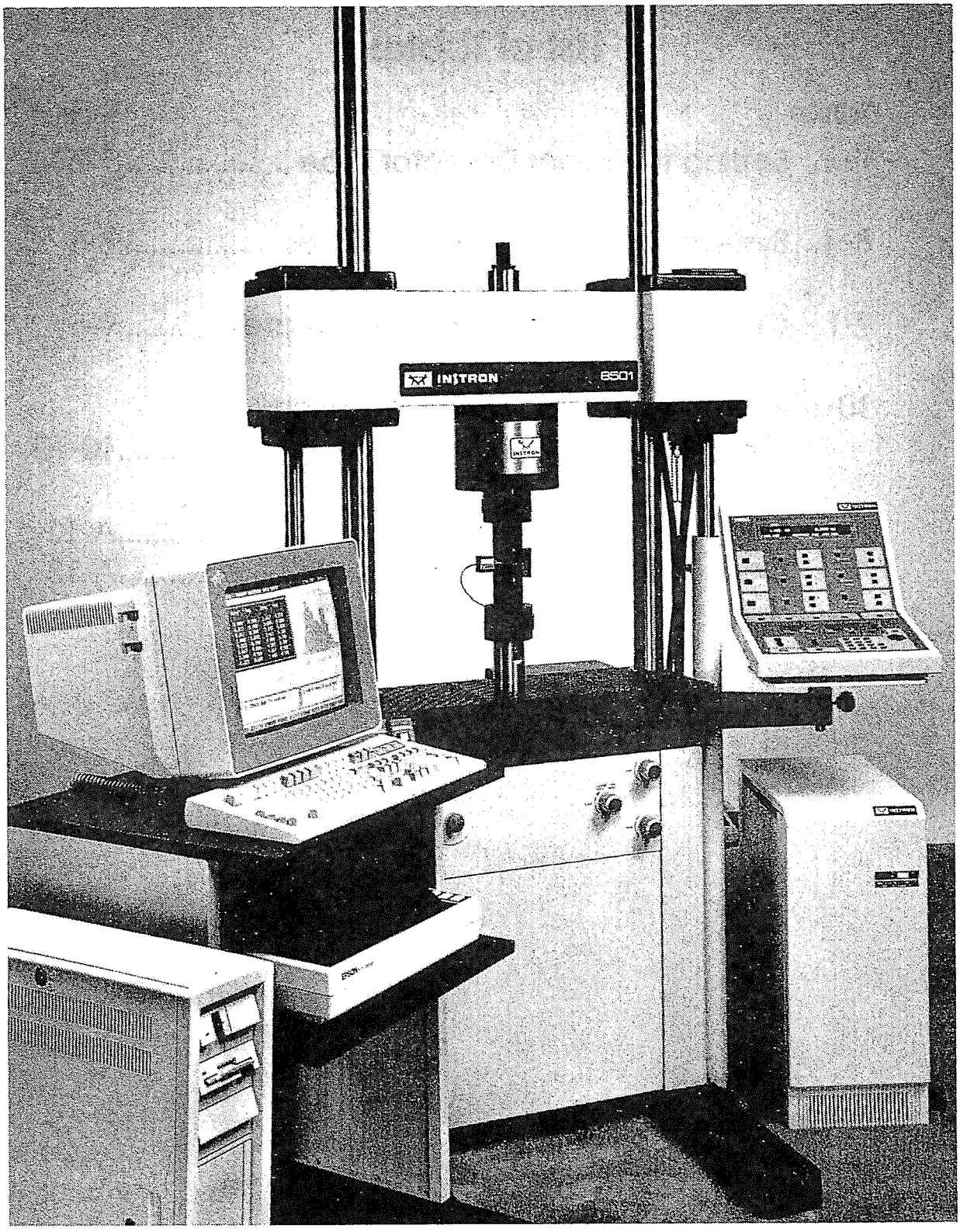
7–1. Setting the Event Detector Type 7-34

8–1. System Parameter Default States.....8-5

9-1. Corporate Manifold Transition States.....9-5

10-1. Examples of Cross-Compensation Applications 10-10

A-1. Sensitivity Settings A-12
A-2. Code Resistance Values A-13



Model 8500 Materials Testing System

Chapter 1
Introduction

Outline

- Introduction . . . . . Page 1-2
- Model 8500 - What It Is And What It Does . . . . . Page 1-6
- Analog versus Digital Control . . . . . Page 1-8
- About This Manual . . . . . Page 1-12

This chapter introduces you to the operating characteristics of the Model 8500 PLUS Testing System. Since the Model 8500 PLUS is a second-generation system, differences between the original Model 8500 and the new Model 8500 PLUS are listed. Later in the chapter, the advantages of digital control over analog control are discussed. Lastly, a description of this manual and what it covers, is given.

Introduction

The Instron Model 8500 Dynamic Materials Testing System is an advanced multiprocessor-based control console which provides full digital control of a testing system. The two main components are the Front Panel for operator interaction, and the Tower Console, which houses triple height circuit boards for powerful closed loop digital control. The digital technology built into the Model 8500 provides drift-free, closed-loop control with absolute repeatability, 32-bit function generation, multiple 16-bit A/D converters, and parallel signal processors to give you accuracy, automatic calibration, auto ranging, programmable event detectors, and a host of other capabilities.

The current version of the Model 8500 is known as the Model 8500 PLUS. It is a second-generation system that incorporates a number of improvements and new features not found in the original Model 8500. If you are familiar with the original Model 8500, you will find a host of enhancements that will make your use of the Model 8500 easier and more capable. If you are not familiar with the original Model 8500, you will find the Model 8500 PLUS to be close to state-of-the-art in servohydraulic materials testing systems. Among the improvements and enhancements are:

- **Adaptive Loop Shaping** – This is a method of loop shaping that accounts for the changes in stiffness of the test specimen as the test proceeds, by adjusting the loop shaping parameters on a continuing basis.
- **Auxiliary Output Jack** (Optional) – This jack is connected to an 18-bit Digital-to-Analog Converter that gives high resolution drive signal for use in an

auxiliary or secondary control loop. This means it can be used for control in control loops such as temperature, pressure, or an accelerometer loop. It is not addressable from the Front Panel, but can be controlled through the computer interface.

- **Increased Control Loop Update Rate** – The Control Loop Update Rate has been increased from 1000 to 5000 updates per second for greater accuracy in the control loop.

- **Derived Feedback** – This is a feedback signal that is mathematically generated by combining two or more actual feedback signals and performing a calculation on them. It is used primarily for deriving True Stress and True Strain.

- **Digital Monitor Jacks** – The rate at which signals on these jacks is checked has been increased from 12 Hz to 1000 Hz. The effect of this is to make the digital input event detectors just as responsive as the system event detectors.

- **Downloadable Firmware** – On standard Model 8500 systems, the system firmware resided on EPROMs, which, once programmed, could not be changed. The Model 8500PLUS uses FLASH memory instead, which can be re-programmed without removing it from the circuit board. The advantages of this are that system upgrades can be accomplished on-site, with a minimum of hassle and down-time.

- **External Analog Waveform Generator Input** – An external analog waveform generator can be used to

provide waveforms for the control loop in all control modes.

- **Improved Analog Monitor Outputs** – The standard Model 8500 offered only one 12-bit DAC to drive the four Analog Monitor Outputs. The Model 8500PLUS now has one 14-bit DAC for each of the four outputs, which permits digital offset of the signal, as well as digital scaling.

- **Improved GPIB Commands** – The speed of processing GPIB Commands has been increased from about 30 commands per second to a constant 125 commands per second, regardless of what the rest of the system is doing. This is accomplished by using a separate command processor that does not get involved in the system's real-time calculations and data logging.

- **Increased Data Logging Rate** – The Data Logging rate has been increased from 1000 to 5000 "rows" of continuous data per second. A "row" of data is a set of position, load, and strain data. This has been made possible by increased processing power in the MDC and higher-speed GPIB transfers of binary data.

- **New Display Screens** – Display screens on the Front Panel Console have been improved for better functionality and to provide access to new features.

- **Real Time Clock** – This has been added to give a time and date stamp to all saved calibration data. The time and date of the last calibration will appear on calibration screens to verify that the current calibration data is valid.