

PPRB  
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S-3150

### S-3150 DIGITAL MEASUREMENT SYSTEM

The Type S-3150 will be a high-speed, disc-programmed, dynamic and DC tester for digital integrated circuits. The measurement system is self-contained and, once programmed, will perform tests on a go, no/go basis or on a diagnostic basis at rates to 100 measurements per second. A Digital Equipment Corporation, PDP-8/L Computer is utilized for on-line data acquisition, off-line data reduction and in writing programs for the DC and dynamic tester with the interactive software that is supplied with the Type S-3150. The Type S-3150 is basically a Type S-3130 with a new programmable IC test station and a small computer used for data acquisition and program writing. This new system provides:

1. Fixture flexibility--only a single load board need be changed to accommodate most logic families, most changes within a family are under program control (loads, power supplies, and stimuli).
2. DC capability--DC currents and voltages may be measured to within 1% in most cases in the same socket as used for the dynamic measurements.
3. Computer controlled data acquisition....no loss in test rate.
4. A special interactive computer program.... generates measurement system programs from the keyboard. It is a plain English program that interacts with the programmer at the keyboard.
5. Use of a disc memory....measurement system may be used for go, no/go and diagnostic testing while the computer is used for batch data reduction or interactive program compilation.

The following instruments comprise the Type S-3150: Type R568 Oscilloscope with the Type 3T6 Programmable Sampling Sweep and Type 3S6 Programmable Sampling Unit; Type R230 Digital Unit; Type R240 Program Control Unit; two Type R250 Auxiliary Program Units; two Type R116 MOD 703L Programmable Pulse Generators; Type R293 MOD 703M Programmable Pulse Generator; Programmable Power Supply (includes 3 voltage and 1 current supply); Disc Memory; Punched Tape Photo Reader; Interface Unit; Computer Coupler; DEC PDP-8/LA (4k memory - ASR33); two DEC Tape Transports; DEC RG-8/L Data Break; DEC DW08 AI/O Conversion Panel; DEC TC01 Tape Auto Control Unit, all mounted in a 3-bay enclosed cabinet with an operator table containing the Programmable Test Station at one side. Included Teletype ASR33 free standing at other side.

Programmable Test Station includes: One Type R287; four Type 286's, sixteen Type S-3 Sampling Heads, 50- $\Omega$  Switches, DC Sub-system, Load Board, Probe Board, including choppers and required cables.

#### TEST STATION

The test station is a free standing console containing a programmable test fixture designed to test digital integrated circuits with up to 16 leads. It is controlled by the measurement system during the test sequence. Each lead of the integrated circuit under test can be independently connected to power supplies, signal sources, load networks, buffer drive circuits, and measurement probes as required. A family of several easily interchangeable plug-on test socket boards allows a variety of socket types to be used and facilitates socket replacement when required. A single load board beneath the test socket holds most of the load networks required for testing a complete family of devices (TTL, DTL, MECL, etc.). Load boards may be interchanged when changing from one family to another or when unusual load

networks are required. A small additional board mounted directly beneath the test socket provides mounting areas for load and driver circuits when they must be located very close to the device under test. This mounting area is also useful when leads of the device under test must be wired together or interconnected with load networks.

#### GENERAL CHARACTERISTICS OF THE TEST STATION

- |  |   |
|--|---|
| 1. Maximum number of device leads  | 16  |
| 2. Integrated circuit packages accepted (directly or in Barnes carriers)       | 14 and 16 lead dual inline<br>14 lead flat pack<br>8, 10, and 12 lead T)-5 pack |
| 3. Number of programmable loads or buffer drive circuits<br>48 total           | normally 3 per 1 lead   |
| 4. Number of programmable voltage supplies<br>4 total                          | 3 directly programmable to all leads<br>1 programmable through load networks    |
| 5. Number of programmable current supplies                                     | 1 programmable to any lead  |
| 6. Measurement probes with programmable X1 and X10 attenuators                 | 16 Type S-3 Sampling Heads,<br>1 per lead                                       |
| 7. Distributed capacitance at each lead attenuator at X10.<br>attenuator at X1 | -15 pF<br>-20 pF  |
| 8. Pulse generator inputs<br>2   | each one programmable directly to any lead or to buffer drive circuits          |
| 9. Number of leads selected for each measurement                               | 2   |
| 10. Forcing capability   | capability to force and measure direct currents and voltages                    |

#### DC MEASUREMENT CHARACTERISTICS OF TEST STATION

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|--|--|
| 1. Voltage measurement range<br>accuracy | +3 mV to +100 V<br>within 1% or 1 mV with auto cal<br>within 4% or 1 mV without auto cal |
|--|--|

- |   |   |
|---|---|
| 2. Voltage forcing<br>range<br>accuracy   | 0 V to $\pm 100$ V<br>0 to 40 V range within 0.2%<br>plus 1 mV<br>0 to 100 V range within 0.2%<br>plus 3 mV                       |
| 3. Current<br>range<br>accuracy<br><br>voltage range over which current<br>measurements can be made | +5 nA to +100 mA<br>within 1% or 2 nA with auto cal<br>within 4% or 2 nA without auto cal<br>-100 V to + 100V                     |
| 4. Current forcing<br>range<br>accuracy   | $\pm 1$ mA to $\pm 200$ mA<br>0 to 1 mA range within 0.2%<br>plus 0.1 $\mu$ A<br>0 to 200 mA range within 0.2%<br>plus 10 $\mu$ A |

## DYNAMIC MEASUREMENT CHARACTERISTICS OF TEST STATION

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|---|---|
| 1. Measurement system risetime<br>including effects of test<br>fixture environment  | less than 1 ns for device source<br>impedance of 25 $\Omega$ or less  |
| 2. Excitation system risetime including<br>effects of test fixture environment<br>(not including pulse generator<br>risetime) | less than 1.0 ns  |
| 3. Voltage measurements<br>range<br>accuracy<br><br>DC offset range<br>safe overload voltage                                  | 3 mV to 16 V<br>within 1% or 1 mV with auto cal<br>within 3% or 1 mV without auto cal<br>20 V to + 20 V<br>100 V peak |

## MEMORY AND PROGRAMMING

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|----------------------------|---|
| 1. Storage capacity        | 1080 measurements   |
| 2. Measurement word format | 144 characters of four bits each<br>(576 bits) plus parity                            |
| 3. Test sequences          | any length from 1 to 1080<br>measurements, sequence may be<br>altered by test results |

- |                           |  |
|---------------------------|--|
| 4. Parity                 | each character checked for even parity compliance  |
| 5. Programmed access time | random access 17 ms (average) can be optimized to approximately 1 ms through minimum access time programming |

#### ANALOG DISPLAY UNIT

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|---------------------|--|
| 1. CRT display area | 8 x 10 divisions each measured division 1 cm |
|---------------------|--|

#### TIME BASE USED FOR TIME MEASUREMENTS

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|---|---|
| Sweep Time/Div<br>range                   | 100 ps to 500 ms in 10 ranges (1-2-5 sequence)  |
| accuracy                                  | within 3%, (within 1% with auto cal)  |
| Delay Ranges Time/Div<br>100, 200, 500 ps | 0 to 1 $\mu$ s in 100 ps increments   |
| 1 ns to 1 $\mu$ s                         | 0 to 10 $\mu$ s in 1 ns increments  |
| 2 $\mu$ s to 500 $\mu$ s                  | 0 to 1 ms in 100 ns increments  |
| 1 ms to 500 ms                            | no delay available  |
| High-speed programming                    | time base equipped with special circuitry which in conjunction with Type R230 Digital Unit resets sweep when measurement is completed or after last memory zone, thus measurement rate is considerably increased especially with low repetition rate signals and when operating at slower sweep rates |

#### PROGRAMMABLE POWER SUPPLIES

- |   |   |
|---|---|
| 48 V Power Supplies (3 each)<br>operating range | 0 V to $\pm 39.99$ V programmed in 10 mV steps at up to 400 mA source, 100 mA sink  |
| 100 V Power Supply (1 each)<br>operating range  | 0 V to $\pm 100$ V ( $\pm 120$ V at reduced current) programmed in 100 mV steps at up to 100 mA source or sink                              |
| Current Supply (1 each)<br>operating range      | 0 mA to $\pm 199.9$ mA programmed in 100 $\mu$ A steps or 0 mA to $\pm 1.000$ mA programmed in 1 $\mu$ A steps (programmed range selection) |

Compliance Voltage  
plus current

-12 V to +100 V, minus current  
+12 V to -100 V

### PROGRAMMABLE PULSE GENERATORS

#### Type R116 MOD 703L

The Type R116 Pulse Generator is modified (MOD 703L) to include 5 program assembly cards that provide digital to analog conversion of program data. All functions of the Type R116 MOD 703L are programmed in the Type S-3150.

Amplitude	$\pm 0.4$ V to $\pm 10$ V in three ranges
Offset (of pulse baseline)	-4.0 to +4.9 V
Rise and Falltime	10 ns to 109 $\mu$ s in four ranges
Period	100 ns to 10.9 ms in five ranges
Width	50 ns to 545 $\mu$ s in four ranges

#### Type R293 MOD 703M

The Type R293 MOD 703M is a modified Tektronix Type R293 furnished with a program assembly designed to program pulse amplitude and pulse width of the pulse generator.

Risetime	1 ns
Falltime	2.5 ns
Repetition rate	100 kHz to 10 kHz (not programmed)
Pulse width	2 ns to 250 ns programmed in 1 ns steps
Pulse amplitude	6 V to 12V programmed in 0.5 V steps
Polarity	$\pm$ (not programmed)
Offset	none

### AUTO CALIBRATION UNIT

The auto calibration unit contains time reference signal and controlling circuits that calibrate the vertical and horizontal of Tektronix Type S-3150 Digital Measurement System. When programmed and connected as part of the system the auto calibration will calibrate the selected deflection factor in the timebase sweep

rate. Automatic deflection factor calibration is accomplished by applying precision DC voltages to a vertical amplifier channel, comparing the output against selected limits and if necessary automatically adjusting the amplifier gain to produce an in-limits output. Calibration of the time-base sweep rate ranges is achieved in a similar manner. Tunnel diode switching waveforms (at the reference frequency rates) are applied to one of the vertical amplifier channels and the time period between given points are compared against selected limits. If necessary, system sweep rates are compensated to produce an in-limits output. The time-base sweep ranges of 0.2 ms thru 1 ns may be calibrated by the auto calibration unit, the other sweep ranges may only be calibrated to the accuracy obtained with manual calibration.

#### Auto Cal Calibration Functions

Type 3S6 (both channels)	10 mV thru 100 mV/div ranges
Tolerance	within 1%
Type 3T6	0.2 ms thru 1 ns/div ranges
Tolerance	within 1%

#### COMPUTER INTERFACE UNIT

The Computer Interface Unit provides an interface between the measurement system and the PDP-8/L Computer. It enables the computer to accept data from the Types 230, 240, and the Tape Reader and to deliver data to the Type 240 and Tape Punch.

#### Provides:

1. Capability of data logging at a rate compatible with measurement speed of the system without data recording.
2. Provides a useful tool for data reduction with proper software.
3. Can control or direct a test sequence directly as a result of each measurement.
4. Provides for the Tape Reader to be used by the Type 240 with a computer.
5. Allows the computer to share the Tape Punch.
6. Allows the programmer to examine, modify, and replace measurement programs in conjunction with the interactive computer program. It is intended that the computer and the measurement system stand alone and only be coupled together when it is desired.

#### DIGITAL COMPUTER

Tektronix Type S-3150 is currently supplied with a PDP-8/L Program Data Processor manufactured by the Digital Equipment Corporation of Maynard, Massachusetts.

A basic software package is supplied with the Type S-3150. Although not required in the operation of Tektronix systems, support software furnished by the computer manufacturer including diagnostic programs and instructions is supplied with the computer.

## SOFTWARE

The software packages available with Tektronix computer operated test systems allows test sequences to be written in plain English, test results to be recorded, and test sequences to be transferred to paper tape for permanent storage. Below is a listing of the programs supplied with the Type S-3150.

### Translator Program

Allows test sequences to be written in plain English either on-line for immediate debugging or off-line allowing the Type S-3150 to make measurements while other tests are being written. A basic understanding of test instrument terminology and device test requirements are the only prerequisites for use of the program.

### Record Test Result Data Program

Allows test results including device code, device serial number, and test number to be recorded on either magnetic tape or TTY. Data from rejected devices, accepted devices may be recorded.

### Disc Test Sequences to Paper Tape Program

Transfers selected test sequences from the system magnetic disc onto paper tape for permanent storage. The system hardware allows the disc to be loaded from paper tape.

### Dimensions

The Type S-3150 is 60 inches high, 84 inches wide, and 34 inches deep, excluding the operator table. Instruments are mounted on slide-out tracks and individually can be pulled out, tilted, and locked in any one of seven positions for convenient access. Approximate shipping weight is 2,500 pounds.

### Power Requirements

105 V to 125 V, 60 Hz, approximately 2,500 watts at 115 V and 60 Hz. Rear panel selectors on each instrument provide rapid accommodation for line-voltage ranges.

### Installation

A Tektronix system specialist installs the Type S-3150. He checks the complete system for proper operation and assures that it meets or exceeds published specifications. Performance checkout software is included as part of the installation.

## Factory Training

Tektronix provides an intensive, four week system training course on the Tektronix Systems.

Theory of operation, programming, calibration, and troubleshooting are discussed for each system instrument as well as the complete system. Classes are held at the Tektronix Industrial Park, Beaverton, Oregon

John Mulvey/Morgan Howells

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