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AUTOMATIC & MANUAL INTEGRATED CIRCUIT TEST EQUIPMENT

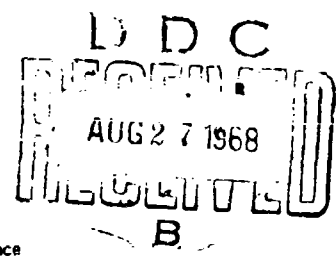
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AUTOMATIC & MANUAL INTEGRATED CIRCUIT TEST EQUIPMENT

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ABSTRACT

This report presents a brief discussion on the various instruments in use today for electrical testing of integrated circuits. A tabulation of commercially available manual and automatic testers is included.

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INTRODUCTION

Electrical testing of integrated circuits is a complex undertaking and a necessary one. It is complex because it involves the testing of a device that is mass produced like a component but must be tested like a circuit; it is necessary because the sooner faulty circuits are detected and eliminated, the more economical their production and use becomes.

The purpose of this report is to examine the problem of integrated circuit testing and the solutions offered by manufacturers of electronic test instrumentation.

INTEGRATED CIRCUIT TESTS

The many tests that can be performed on an integrated circuit fall under one of three main categories: static, functional, and dynamic. To avoid confusion it is important to define these categories exactly: the nomenclature used by manufacturers varies and in some instances two or more different terms are used to refer to the same kind of test.

Static or dc testing includes the checking of dc parameters such as leakage current, dc voltages and currents, and dc gain. Detection of open and short circuits is also considered part of the static test.

In functional testing the aim is to establish whether the device under test will operate, but not whether it will rigorously meet its specifications. The test merely shows that the device functions, hence its name.

Dynamic tests include pulse amplitude, rise and fall time, propagation delay, frequency response, voltage gain, and switching time measurements. Some of these (switching time, propagation delay) are important in digital circuits while others (frequency response, gain) pertain mainly to analog devices.

In addition to the above, it is often desirable to perform life tests and environmental tests. These involve respectively, applying test stimuli and monitoring the outputs of the i.c. under test for an extended period of time or over wide ranges of temperature.

In order to completely check an integrated circuit, it would be necessary to perform a large number of the tests just described, including life and environmental tests. This is, at least at present, not practical either in terms of time or expense. Manufacturers and users of integrated circuits, therefore, must compromise on the number and thoroughness of the tests they perform.

Static tests are the most common since they are comparatively easy and inexpensive, and satisfactory for many applications. Functional tests are often used with logic circuits, especially when the dynamic characteristics are not of primary importance. With linear circuits, or when logic circuits are required to meet strictly their dynamic specifications, dynamic tests become necessary. Dynamic tests are both difficult to perform and expensive, and they do not obviate the need for static testing since some faults can only be detected with the latter type of test.

INTEGRATED CIRCUIT TEST EQUIPMENT

The variety of test instruments for integrated circuits is almost as great as that of possible tests, and in many respects more bewildering. Integrated circuit testers range from inexpensive, manually operated

instruments to very costly, complex, and fast test systems; some are able to perform only the simpler dc and functional tests, others are equipped for all types of dynamic tests; the accuracy of their measurements varies widely as does the way in which test results are displayed.

For these reasons, it is difficult to classify i.c. testers, but they can be nevertheless differentiated according to several criteria, including the following: method of programming, types of circuits tested, and type of tests performed. Other important characteristics, such as speed of testing and readout of test results, are usually related to the programming method and will be considered together with it.

Before entering into a discussion of how i.c. testers differ as to method of programming it is necessary to make clear what we mean by this phrase. "Programming" as used here denotes not only the electronic coding of test instructions into a tape, card, or computer memory, but also the manual wiring or setting up of a test instrument to perform one or more tests. In this way we will refer to an instrument as being "programmed with a crossbar switch matrix", "programmed by magnetic disc", "computer controlled", etc.*

The different programming methods utilized in integrated circuit test equipment reflect their complexity, test capabilities, and cost. Four types of testers can be thus distinguished: computer controlled, tape, card, or disc programmed, printed circuit card programmed, and matrix programmed.

The computer controlled testers offer the most sophisticated, fast, and reliable means of testing integrated circuits. This type of tester is governed by a computer into whose memory is stored a program containing instructions to perform the desired tests. The computer, following the test program, sets tests stimuli, makes the appropriate connections and monitors the test results. An advantage of using a computer to control the test system is that decisions can be made by it based on previous test results. Variable word-length languages are most commonly used to write the test program since they do not require a fixed number of instruction words per test and thus provide flexibility for expansion.

In order to make full use of the very high potential test rates** of computer controlled systems, automatic handling equipment becomes necessary. A detailed description of this equipment is given on page of this report. A special type of handler is the wafer prober which makes it possible to perform tests at the wafer level, before the i.c.'s are diced and packaged.

*The commonly used terms "automatic", "semi-automatic", and "manual" have in general been avoided because the distinction between automatic and non-automatic testers is self evident while the classification of the latter type into semi-automatic and manual instruments is not an easy one to make. Non-automatic testers can perform from 1 to about 40 or 50 tests, and many of them can be sequenced automatically as well as manually. This leads to difficulties in deciding where to draw the manual/semi-automatic line. Nevertheless, the description of testers contained in the tabulation (p.13) gives a good idea of the capabilities of each.

**Test rates of 10,000 tests/sec are possible with the Fairchild 8000A, for example. This system, however, is designed to perform the simpler and quicker functional tests. Rates for dynamic testers are notably lower, e.g., 200 tests/sec with the E-H 4002.

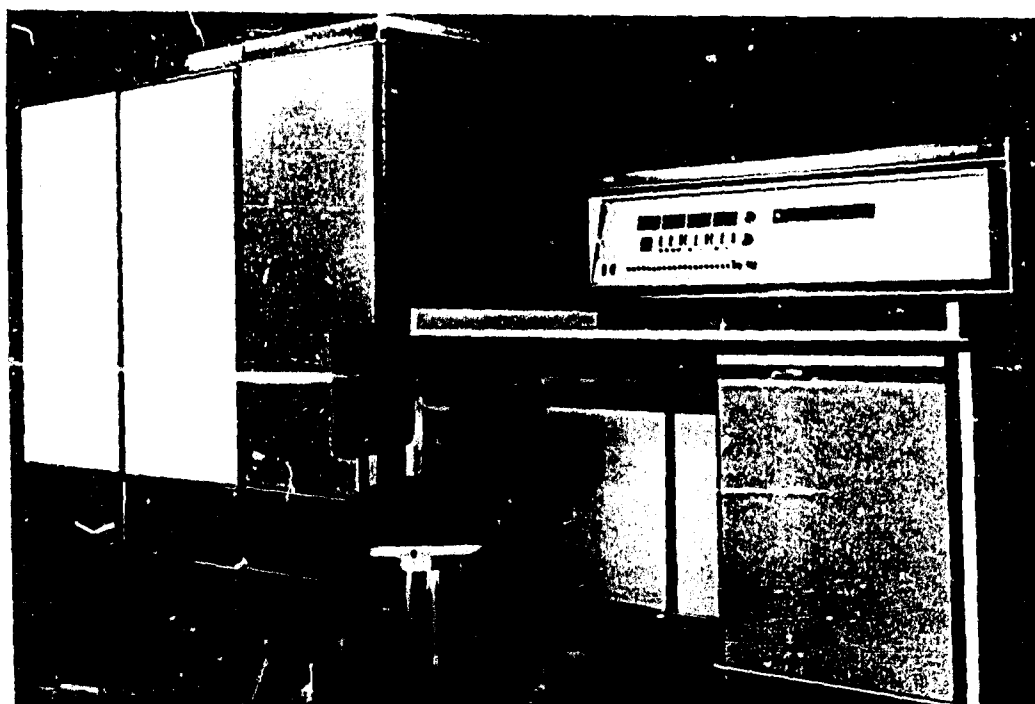


FIGURE 1

The Series 5000 Automatic Test Center by Fairchild Instrumentation is a complete controlled system for static and dynamic testing of integrated circuits. Test programs are stored in a 45 track magnetic disc memory with capacity for 3000 tests.

Another feature available in computer controlled test systems is the ability to record test results either as go/no-go indications, measured values, or both, together with such information as serial number, test number, and test limits. Printers, card punches, and tape recorders are commonly used for data logging purposes.

Tape and disc programmed testers are similar to the computer controlled systems in that the instructions to perform all necessary tests can be electronically programmed. These testers however, do not have the flexibility of the computer controlled type as all tests must be performed in a serial manner in the order they appear on the tape or disc.

Automatic handling equipment and data logging are available with most instruments of this class. Test speeds are, in general, somewhat lower than those achieved by the computerized systems.

Testers programmed by printed circuit cards are specially useful for testing digital i.c.'s at high rates but not with high accuracy. These instruments use one or two program cards which contain a good device of the type being tested plus the circuitry necessary to establish the desired loading condition. Testing reduces to subjecting the good device

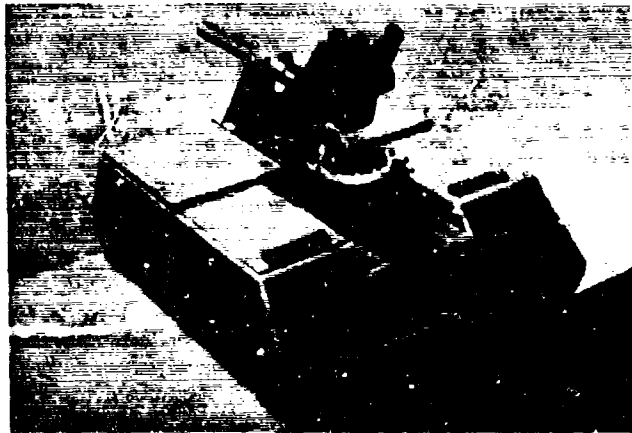


FIGURE 2

Micro Tech's Model 2818 Automatic Probing System tests semiconductor wafers up to 2" in diameter, as well as chips down to 3/8". The wafer chuck steps in preset increments bringing each device into contact with the stationary probe points.



FIGURE 3

Model 4003 Dynamic Test System, manufactured by E-H Research Laboratories, uses punched cards for programming up to 81 sequential tests. A second card reader may be added to increase program flexibility.

and the one under test to the same stimuli and comparing their outputs. The results of this comparison are then displayed as go/no-go indications, usually on front panel lamps. Automatic equipment is often used to feed the integrated circuits to the tester.

An advantage of this kind of tester is the ease with which it can be programmed. If the pc cards needed to test a particular device are available, programming reduces to inserting them into the tester. Manufacturers provide cards for testing the most commonly used i.c.'s. Cards for other i.c.'s can be wired by the manufacturer on request or by the user himself.



FIGURE 4

Model 851 I.C. Tester by Monitor Systems, Inc. uses prewired program modules that are inserted into the tester to perform static, functional, and dynamic tests. External instruments are needed for readout.

Under the name of matrix programmed testers are included diverse instruments whose common characteristic is that they are programmed manually using a crossbar switch matrix or a patch board. Programming consists in establishing the proper connections between the test power supplies, meters, i.c. leads, and ground. Depending on the degree of sophistication of the particular instrument, one test set up will be sufficient for one test, or a series of tests.*

The testers in this category are best suited for testing small to medium size lots of integrated circuits (5000 units per month is about the upper limit for the more powerful instruments) and for laboratory work. Some of them are designed with this purpose in mind and they provide the most

*The more expensive matrix programmed testers are capable of performing as many as 40 to 50 tests with one test set up. Tests are sequenced using pushbuttons on the front panel.

accurate means available for making measurements of i.c. parameters*.

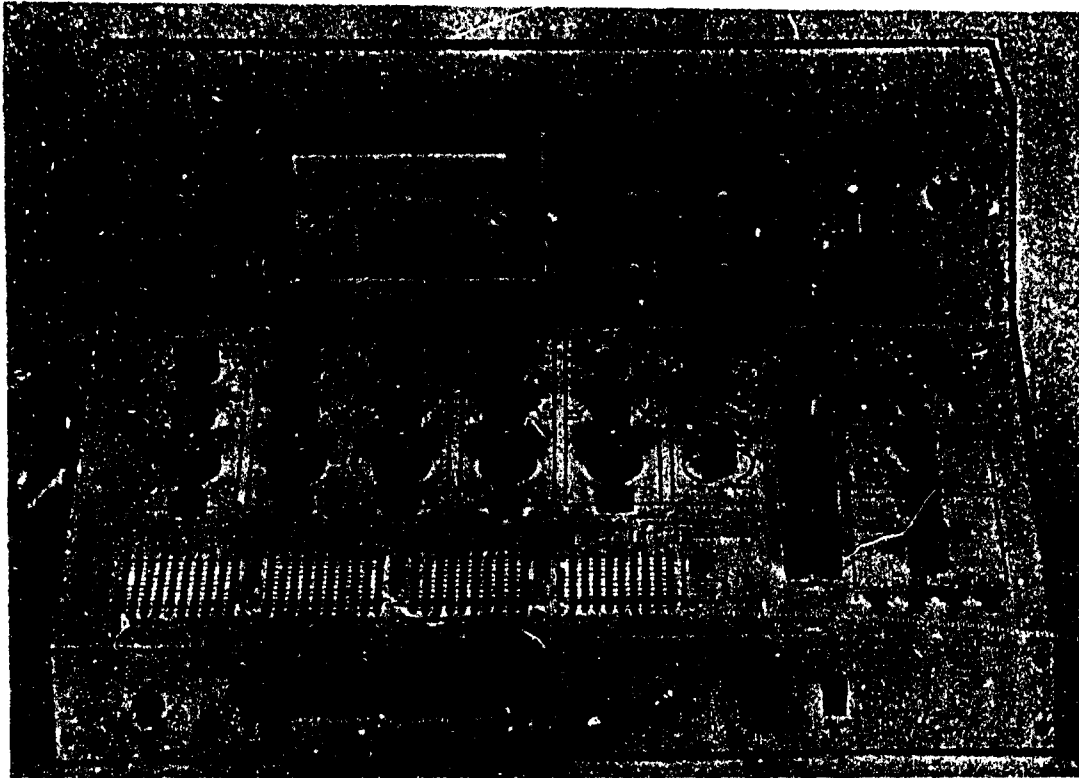


FIGURE 5

This desktop tester by Microdyne (Model 715) can be programmed using the front panel cross-bar switches or plugging in prewired program modules. An analog meter is used for readout.

Of course, not all testers can be included in one of the categories discussed above. Some specialized instruments, like those used to perform life tests or noise immunity tests have unique features of their own, but since they are a small minority, they will not be discussed here.

We will next review briefly i.c. test instrumentation from the point of view of the device being tested. This includes both the type of i.c.'s that can be tested and the type of tests that they can be subjected to.

Integrated circuits in use today can be divided into two groups: digital and linear. The digital circuits are driven by binary logic (true/false) inputs and their outputs are functions of these logic inputs according

*The Redcor Model 990, for example, is capable of measuring voltages from 1mv to 100v and currents of 100na to 1a with 1% fs accuracy. Its power supplies are accurate to $\pm 0.1\%$.

to some truth table. Logic gates, counters, adders, etc. are digital circuits. Operational amplifiers are the most common type of linear integrated circuit and they are characterized by a frequency dependent transfer function that relates input and output.

Test requirements of digital and linear circuits are different. The former are often considered satisfactory if they can pass static and functional tests, dynamic tests being necessary only if it is desired to insure that such parameters as switching time and pulse delay meet the stated specifications. Linear i.c.'s, on the other hand, are usually subjected to dynamic tests besides the usual static checks.

In view of this, it is clear that an instrument capable of performing only static and/or functional tests will be most useful for checking digital i.c.'s and that the capability to perform dynamic testing is very desirable in a tester used for linear circuits.

Dynamic tests being the most difficult to perform, it is not surprising to find that instruments capable of performing them are not very abundant. The number of testers that can dynamically check both digital and linear circuits is even smaller. Still, a fair number of dynamic testers, automatic and manual, are available.

At least five companies* manufacture automatic test systems that can perform dynamic tests, but of these only three offer equipment capable of handling linear circuits.

Several of the smaller, manually programmed instruments have dynamic test options that can be implemented by adding a signal generator module and an external sampling oscilloscope.

The sampling method is the most commonly used for measuring dynamic parameters but there are some exceptions, such as the E-H Research Labs Models 4002 and 4003 which use the "single-shot" technique. This technique is applicable to digital integrated circuits and consists in "pre-conditioning" the device to be tested by applying to it all but the last input necessary to obtain an output signal, then waiting for thermal and change stabilization to take place, and finally applying the last input signal and monitoring the output. The greatest advantage of this technique is the saving in time that results from the elimination of repetitive measurements needed for sampling.

This completes our discussion of electrical testing of integrated circuits, except for a few remarks on automatic handling equipment that appear below.

*See tabulation, p.

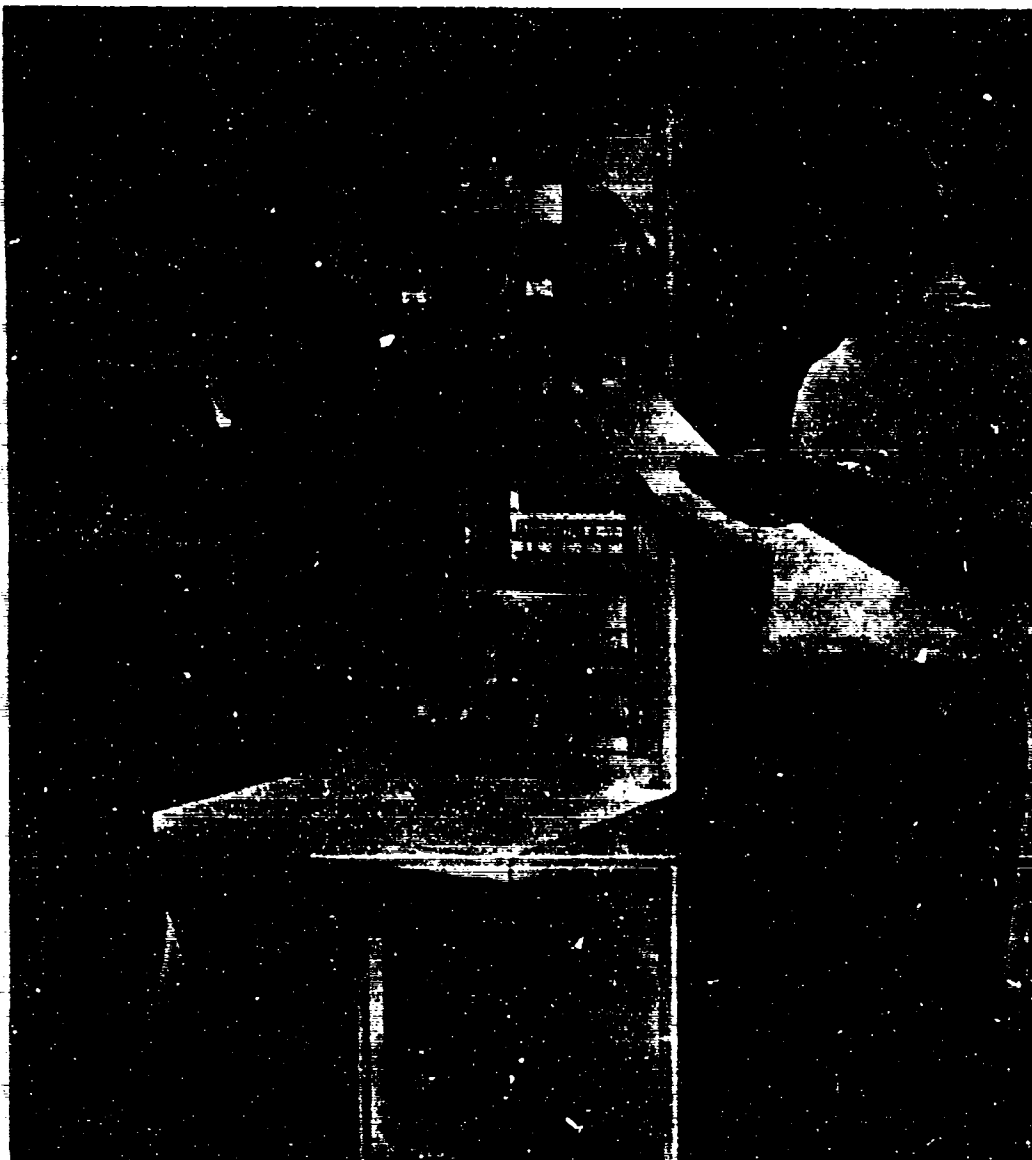


FIGURE 6

Automated Measurements Corporation's 9001 Dynamic Test System is programmed by tape to perform dynamic tests on logic integrated circuits. A sampling oscilloscope and digital voltmeter are used for making the dynamic measurements.



FIGURE 7

Test programs are entered into the E-H Research Laboratories' 4002 Dynamic Test System using a Friden Flexowriter or a high speed optical tape reader. The system performs switching time and dynamic voltage level measurements on digital i.c.'s and arrays.

AUTOMATIC HANDLING EQUIPMENT FOR INTEGRATED CIRCUITS

We have already pointed out the convenience of using automatic handlers with test equipment capable of high test rates. Therefore, we will limit ourselves in this section to describing them in more detail.

The simplest type includes a feeding magazine, tray, or bowl, a test head module, and two output bins (for good devices and for rejects). The i.c.'s to be checked are fed to the test head and, once in position, stimuli from the test system that controls the handler are applied. The i.c.'s are then sorted according to the test results. More elaborate units have a greater number of sorting bins for grade classification.*

*Note, however, that since the handling system is controlled by the i.c. tester the signals necessary to operate the sorting module must come from the tester itself.

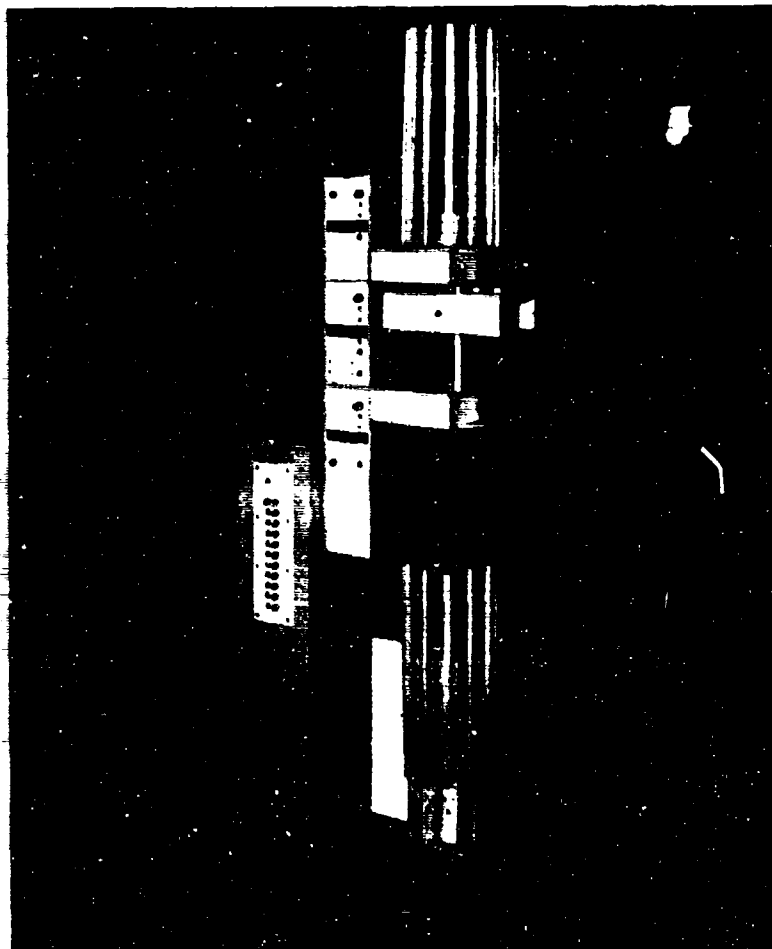


FIGURE 8

Unitek's DIP Testing and Handling System is composed of a Preload Module, a Test Module, and a Sort Module. It is capable of testing and classifying up to 2000DIP packages an hour.

Some handling equipment is specially designed for testing integrated circuits while still on the wafer. This is a delicate test since unpackaged i.c.'s can be very easily damaged; the probes used for contacting them must not exert excessive pressure lest the metallization pads be damaged. Most wafer probing systems have provisions for inking and classifying the devices tested.

I.C. manufacturers find it advantageous to perform at least some test (usually dc) at the wafer level because of the savings that result from avoiding further processing of faulty devices.



FIGURE 9

Model 2820 Wafer Probing System by Micro Tech: Stepping can be controlled by a precision optical mask scanned by a photocell, or else x and y increments can be set on a digital dial.

Finally, environmental testing is possible with some handlers that incorporate a controlled temperature chamber inside which tests are conducted.

A partial list of manufacturer's of automatic handling equipment is given in Table 1.

TABLE I

AUTOMATIC HANDLING EQUIPMENT FOR J.C.'s:

<u>MANUFACTURER</u>	<u>MODEL</u>	<u>TYPE</u>
Electroglass, Inc. Wayne, Pennsylvania	920-HC 920-R 131-AHC	automatic wafer prober automatic wafer prober semiautomatic wafer prober
Barnes Corporation Lansdowne, Pennsylvania	TH037-B02 TH037-B03 TH037-B05 TH037-B06 TH037-B07 TH037-B08	automatic i.c. handler environmental handler bowl-fed flat pack handler bowl-fed dual-in-line handler bowl-fed T0-5 handler bowl-fed flat pack, dual-in-line, and T0-5 handler
Micro Tech, Inc. Worcester, Massachusetts	2818 2819 2820	automatic wafer prober automatic wafer prober automatic wafer prober
Transistor Automation Corp. Cambridge, Massachusetts	XY-540 XY-640S ICT-500	automatic wafer prober automatic wafer prober environmental handler
Unitek Corporation Monrovia, California	8-143-01 8-144-01 8-145-01	dual-in-line package handler dual-in-line package handler dual-in-line package handler

TABULATION

The items contained in this tabulation are integrated circuit testers and test systems currently available from commercial manufacturers. They are listed in alphanumeric order by manufacturer's name and model number.

The specifications shown on this tabulation are intended merely to give an idea of the type and capability of each tester. For a more detailed description, the reader is referred to the listing that follows the tabulation (page 24). The number on the left hand side of each instrument included on the tabulation corresponds to the same number in the listing.

	MANUFACTURER	NAME	METHOD OF PROGRAMMING	CIRCUITS TESTED	TESTS PERFORMED
1.	AAI Corporation Pacific Division Northridge, Calif.	Microcircuit Test System Series 1000	Magnetic disc programmed or computer con- trolled	Digital and linear	Static, dy- namic, func- tional, en- vironmental
2.	Aerotronic Associates, Inc. Contoocook, N.H.	Integrated Circuit Life Test System Model 707	Front panel dials and switches	N.S.	Static life test
3.	Aerotronic Associates, Inc. Contoocook, N.H.	Integrated Circuit Test Set Model 1061	Digit switch matrix	Digital and linear	Static
4.	Aerotronic Associates, Inc. Contoocook, N.H.	Integrated Circuit Test System Model 1061 with plug board pro- grammer	Patch board for up to 20 tests, (ex- pandable op- tionally)	Digital and linear	Static
5.	Aerotronic Associates, Inc. Contoocook, N.H.	Integrated Circuit Test System Model 1061 with computer control	Computer Controlled	Digital and linear	Static
6.	Aritech Corp. Boston, Mass.	Integrated Circuit Tester Model ICT-516	Patch board or prewired patch plug	Digital	Static, functional
7.	Automated Measurements Corp. Los Gatos, Calif.	Dynamics Test System Model 9001	Tape, disc, or drum pro- grammed or computer controlled	Digital	Static, dynamic
8.	Beckman Instruments Inc. Richmond, Calif.	Integrated Circuit Tester Model 999	Pin board matrix	Digital	Static
9.	Birtcher Corp. Monterey Park Calif.	Integrated Circuit Test System Model 800	Crossbar switch matrix	Digital	Static, functional

TEST RATE	READOUT	COMMENTS	PRICE
60 tests/sec to 180 tests/sec	Go/no-go, digital meter, and data logging	Test capabilities, rates and control depend on options selected	\$64,000
See comments	N.S.	Circuits to be tested are placed in oven (50° to 150°C ±2°C) for desired period of time	N.S.
N.S.	Front panel digital meter	Adapters with high frequency output are available for dynamic tests	\$ 4,700
N.S.	Front panel digital meter and go/no-go	Tests can be sequenced manually or automatically, with go/no-go readout	N.S.
N.S.	N.S.	System can be interfaced with Bit Computer (Business Technology, Inc.) on other standard computers	N.S.
N.S.	Go/no-go		\$ 250
15 tests/sec	Digital meter and data logging	Can also test microwave integrated circuits. Data logging output is optional	N.S.
N.S.	Analog meter		\$ 495
1 test/sec	Analog meter	Digital voltmeter can be connected to test set for monitoring and recording. (optional)	N.S.

	MANUFACTURER	NAME	METHOD OF PROGRAMMING	CIRCUITS TESTED	TESTS PERFORMED
10.	Birtcher Corp. Monterey Park, Calif.	Integrated Circuit Test System Model 801	Crossbar switch matrix	Digital and linear	Static, dynamic, functional
11.	Computer Test Corp. Cherry Hill, N.J.	Semi-Auto- matic In- tegrated Circuit Analyzer Model MICA-150	Two crossbar switch matrices	Digital	Static, functional
12.	Continental Device Corp. Hawthorne, Calif.	Multi-Ter- minal Test Unit Model 9522-1	Patch panel	Digital	Static
13.	Continental Device Corp. Hawthorne, Calif.	Multi-Ter- minal Test Unit Model 9522-3	Patch panel	Digital	Static
14.	Continental Device Corp. Hawthorne, Calif.	Hi-Speed Integrated Circuit Tester Model 9545	Printed cir- cuit plug-in card	Digital	Static
15.	Continental Device Corp. Hawthorne, Calif.	SCAT 24	Tape or mag- netic disc	Digital and linear	Static, functional, dynamic
16.	Continental Device Corp. Hawthorne, Calif.	SCAT 26	A variety of program tech- niques are available, from patch panel to mag- netic disc	Digital	Static
17.	Continental Device Corp. Hawthorne, Calif.	SCAT 28	Paper tape	Digital and Linear	Static, functional, dynamic
18.	E-H Research Laboratories, Inc. Oakland, Calif.	Dynamic Test System Model 4002	Mylar or paper tape is used to load program into a Memory Stor- age Unit	Digital	Dynamic

TEST RATE	READOUT	COMMENTS	PRICE
1 test/sec	Analog meter, and oscilloscope	Oscilloscope and signal source modules must be added for dynamic tests	N.S.
1 test/sec	Digital meter	Analog meter can be used for readout, at lower total cost (\$8,800)	\$11,200
N.S.	Analog meter	Model 9522-2 is identical to 9522-1 except for the power supplies	\$ 995
N.S.	Analog meter	Model 9522-4 is similar to 9522-3 except for power supplies	\$ 1,595
>60 tests/sec in automatic mode	Digital meter and/or go/no-go detector	Tests can be sequenced manually or automatically	N.S.
N.S.	Digital meter, oscilloscope and data logging	SCAT 24 series of testers is composed of three models (24-7, 24-8, 24-9) See main listing for details	N.S.
N.S.	See comments	SCAT 26 is a modular system. Programming, test capabilities, readout, etc. depend on modules chosen. Price varies according to modules chosen.	See comments
>50 tests/sec	Digital meter, oscilloscope and data logging		\$45,000
200 tests/sec (dual limit)	Digital meter, go/no-go, and data logging	Can test large scale arrays	\$153,000

	MANUFACTURER	NAME	METHOD OF PROGRAMMING	CIRCUITS TESTED	TESTS PERFORMED
19.	E-H Research Laboratories, Inc. Oakland, Calif.	Dynamic Test System Model 4003	Punched cards	Digital	Dynamic
20.	Fairchild Instrumentation Sunnyvale, Calif.	Automatic Test System Series 4000M	Magnetic disc programmed or computer controlled	Digital and linear	Static, dynamic, environmental
21.	Fairchild Instrumentation Sunnyvale, Calif.	Automatic Test Center Series 5000	Magnetic disc programmed or computer controlled	Digital and linear	Static, dynamic, environmental
22.	Fairchild Instrumentation Sunnyvale, Calif.	Array Test System Series 8000A	Computer controlled	Digital	Functional
23.	Fisher-Akin Co. Manhattan Beach, California	Automatic Integrated Circuit Tester Model 172	Paper tape	Digital	Static
24.	3M Company Camarillo, Calif.	Automatic Test System 9400 Series	Paper tape	Digital	Static
25.	Microdyne Instruments, Inc. Waltham, Mass.	Integrated Circuit Tester Model 701	Patch plug	Digital	Static, functional
26.	Microdyne Instruments, Inc. Waltham, Mass.	Integrated Circuit Tester Model 710	Patch plug or matrix	Digital and linear	Static, functional
27.	Microdyne Instruments, Inc. Waltham, Mass.	Integrated Circuit Tester Model 711	Patch plug or matrix	Digital and linear	Static, functional
28.	Microdyne Instruments, Inc. Waltham, Mass.	Integrated Circuit Tester Model 715	Patch plug or matrix	Digital and linear	Static, functional
29.	Microdyne Instruments, Inc. Waltham, Mass.	Integrated Circuit Tester Model 716	Patch plug or matrix	Digital and linear	Static, functional

TEST RATE	READOUT	COMMENTS	PRICE
60 tests/sec	Digital meter, go/no-go, and data logging		\$37,500
100 tests/sec	Digital meter, go/no-go, and data logging	Program can be entered into tester manually or by means of a tape reader	N.S.
200 tests/sec (dual limit)	Digital meter, go/no-go, and data logging	Test rate goes up to 400 tests/sec for single limit tests	N.S.
10,000 tests/sec	Digital meter and data logging	Capable of testing complex arrays and LSI circuits. (up to 144 pins)	N.S.
5 tests/sec	Go/no-go	Out of tolerance (no-go) values are printed out	N.S.
900 devices/hr	Digital meter, go/no-go, and data logging		\$40,000
2 devices/min	Analog meter	The patch plug is pre-wired to perform the desired tests and plugged into the tester	\$ 675
2 devices/min	Analog meter		\$ 995
2 devices/min	Digital meter		\$ 1,495
2 devices/min	Analog meter		\$ 1,890
2 devices/min	Digital meter		\$ 2,195

	MANUFACTURER	NAME	METHOD OF PROGRAMMING	CIRCUITS TESTED	TESTS PERFORMED
30.	Monitor Systems, Inc. Fort Washington, Pennsylvania	Integrated Circuit Tester Model 851	Prewired plug-in program module	Digital and linear	Static, functional, dynamic
31.	Optimized Devices, Inc. Pleasantville, New York	Integrated Circuit Analyzer Model IC 101	Matrix	Digital	Static
32.	Optimized Devices, Inc. Pleasantville, New York	Integrated Circuit Test Set Model IC 102	Two digital switch matrices	Digital and linear	Static, dynamic
33.	Optimized Devices, Inc. Pleasantville, New York	Logic Circuit Test Set Model LT 101	Plug-in circuit cards	Digital	Static, functional
34.	Optimized Devices, Inc. Pleasantville, New York	Operational Amplifier Test Set Model OPT-101	Programmed front panel dials and switches	Linear	Static, dynamic
35.	Optimized Devices, Inc. Pleasantville, New York	Integrated Circuit Test System Model 5000	Magnetic Disc Programmed	Digital and linear	Static, functional, dynamic
36.	Quan-Tech Laboratories, Inc. Whippany, N.J.	Integrated Circuit Noise Analyzer Model 2283-2181	Plug-in printed circuit card and front panel switches	Linear	Dynamic (noise measurement)
37.	Redcor Corp. Canoga Park, California	IC Test System Model 990/125	Digit switch matrix	Digital and linear	Static, functional, dynamic
38.	Redcor Corp. Canoga Park, California	IC Test System Model 990/135	Digit switch matrix	Digital and linear	Static, functional, dynamic
39.	Signetics Corp. Sunnyvale, Calif.	IC Tester Model 1100	Plug-in circuit card	Digital	Static, functional, dynamic

TEST RATE	READOUT	COMMENTS	PRICE
4 devices/ min	External oscilloscope or meter	Sampling oscilloscope must be added to perform dynamic tests	\$ 1,920
N.S.	Analog panel voltmeter	Current readout and digital voltage readout are optional	\$ 1,600
N.S.	Analog meter, and oscilloscope	Digital and go/no-go readout available as options. An external oscilloscope is needed for dynamic tests	N.S.
2500 tests/ sec	Go/no-go	Manual program dials are available as an option	N.S.
1 test/sec	Analog meter, go/no-go, and data logging	Dynamic tests require a signal source and an oscilloscope. Go-no-go readout and data logging are optional	N.S.
N.S.	Go/no-go, data logging, and digital meter	Can be controlled by a computer. Dynamic tests are optional	N.S.
N.S.	Analog meters	Noise measurements are made at five frequencies simultaneously from 10Hz to 100kHz	\$ 3,950
1 test/sec	Analog meter	Oscilloscope is needed for dynamic tests	\$ 4,950
1 test/sec	Digital meter	Oscilloscope is needed for dynamic tests	5,950
40 tests/ sec	Go/no-go		\$ 4,995

	MANUFACTURER	NAME	METHOD OF PROGRAMMING	CIRCUITS TESTED	TESTS PERFORMED
40.	Teradyne, Inc. Boston, Mass.	Analogical Circuit Test Instrument (Act 1) Model J133	Two plug-in circuit cards	Digital	Static, functional
41.	Teradyne, Inc. Boston, Mass.	Computer Operated Circuit Test System Model J259	Computer controlled	Digital	Static, functional
42.	Texas Instruments, Inc. Houston, Texas	Integrated Circuit Tester Model 659A	Plug-in board	Digital	Static
43.	Texas Instruments, Inc. Houston, Texas	Integrated Circuit Tester Model 659B	Plug-in board	Digital	Static
44.	Texas Instruments, Inc. Houston, Texas	Integrated Circuit Tester Model 662	Plug-in board	Digital	Static, functional
45.	Texas Instruments, Inc. Houston, Texas	Integrated Circuit Test System Model 668	Tape pro- grammed or computer controlled	Digital	Static, functional

TEST RATE	READOUT	COMMENTS	PRICE
450 devices/ hr	Go/no-go	Test rate goes up to 7000 devices/hr with automatic handling equipment	\$ 4,850
200 to 500 tests/sec	Go/no-go and data logging		N.S.
20 tests/ sec max.	Go/no-go		N.S.
20 tests/ sec max.	Go/no-go, and digital voltmeter	Digital voltmeter read- out is optional	N.S.
5 tests/ sec max.	Digital meter and data logging		N.S.
125 tests/ sec max.	Go/no-go	Can operate on "time shared" basis	N.S.

1. AAI CORPORATION, PACIFIC DIVISION
NORTHRIDGE, CALIFORNIA
MICROCIRCUIT TEST SYSTEM
SERIES 1000

A disc programmed system used for incoming inspection, evaluation, and reliability studies, and for manufacturing process testing, including sort and grade classification with wafer and die marking outputs. Tests may be performed as go/no-go with data logging output, and/or visual display. The basic model performs static and functional tests on digital devices; dynamic and environmental tests on both digital and linear circuits can be carried out by adding the appropriate modules to the system. Kelvin connections are used for all static tests.

Three voltage supplies provide input voltages to the device under test of 0 to ± 1 , ± 10 , and ± 100 v; one current supply provides 0 to ± 1 , ± 10 , and ± 100 μ a. Readout ranges are 0 to ± 100 v (3 ranges) and 0 to ± 100 ma (6 ranges).

Programs are stored in a 15 track magnetic disc memory using an input device which can range from a tape reader to a digital computer. The program format allows for the addition of options such as classification, data logging, conditional jump, and parameter distribution.

2. AEROTRONIC ASSOCIATES, INC.
CONTOOCCOOK, NEW HAMPSHIRE
INTEGRATED CIRCUIT LIFE TEST SYSTEM
MODEL 707

Performs dc life tests on integrated circuits which are placed into its temperature controlled oven on plug-in test trays. These trays contain the necessary connections to the power supplies (0 to 10, 20v). Oven temperature range is 50° to $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$. A seven day temperature recorder is attached to the exposed side of the cabinet and a temperature sensor is mounted inside the oven to supply an indication of the system operating temperature.

3. AEROTRONIC ASSOCIATES, INC.
CONTOOCOOK, NEW HAMPSHIRE
INTEGRATED CIRCUIT TEST SET
MODEL 1061

The basic set allows for programming any of 20 leads of an integrated circuit to any one of four power supplies, three external levels, a pulser, or ground. Digit switches are used to establish the desired (Kelvin) connections. Input voltage ranges are 0 to ± 1 , ± 10 v; input current ranges: 0 to ± 1 , ± 10 , ± 100 ma, 0 to ± 1 a.

A digital meter is used to read out voltage and current. Voltage readout ranges: 0 to ± 1 , ± 10 , ± 100 v; current ranges: 0 to ± 1 , ± 10 , ± 100 ma, 0 to ± 1 , ± 10 , ± 100 ma, and ± 1 a.

Adapters with high frequency inputs are available for dynamic measurements.

4. AEROTRONIC ASSOCIATES, INC.
CONTOOCOOK, NEW HAMPSHIRE
INTEGRATED CIRCUIT TEST SYSTEM
MODEL 1061 WITH PLUG BOARD PROGRAMMER

The basic programmer converts the 1061 Test Set to semi-automatic 20 test operation or to 20 test operation with go/no-go readout. For semi-automatic operation, the operator sequences the tests manually by means of push buttons. For automatic (go/no-go) operation, a sequencer and comparator are supplied.

Input voltages and currents, and measurement ranges are the same as for the standard 1061 Test Set.

Special programmers are available to provide more than 20 tests.

5. AEROTRONIC ASSOCIATES, INC.
CONTOOCOOK, NEW HAMPSHIRE
INTEGRATED CIRCUIT TEST SYSTEM
MODEL 1061 WITH COMPUTER CONTROL

This system is composed of a standard 1061 Test Set mated to a digital computer. The computer sets up the test conditions and operates the test set. Inputs and measurement ranges are the same as for the standard 1061.

6. ARITECH CORPORATION
BOSTON, MASSACHUSETTS
INTEGRATED CIRCUIT TESTER
MODEL ICT-516

A low cost instrument designed to perform static and functional go/no-go tests on all types of RTL, DTL, TTL, and ECL logic integrated circuits. Test conditions are set up by means of a patch panel or by inserting a pre-programmed patch plug into the tester. The power supply provides voltage levels of 3.3v and 5.2v. A built-in signal generator supplies forcing functions at 2Hz and 4kHz. When using the latter, the output from the circuit under test must be monitored with an oscilloscope.

7. AUTOMATED MEASUREMENTS CORPORATION
LOS GATOS, CALIFORNIA
DYNAMIC TEST SYSTEM
MODEL 9001

A tape programmed system for dynamic testing of logic integrated circuits having up to 16 pins. The system may also be programmed using a magnetic disc or drum, or it can be controlled by a digital computer. The system can operate in three modes: single test, stop-on fail, and continuous testing.

The 9001 uses ten AMC Type 904 Remote Sampling Units, any two of which may be selected for a given test according to the system program. These units have an input impedance of $1M\Omega$, shunted by $43pf$. An E-H Model 139B pulse generator provides pulses of $\pm 30mv$ to $\pm 10v$ at 10Hz to 50MHz. Using an external clock, repetition frequencies of 0 to 50MHz can be obtained. Rise and fall times are 6nsec to 3msec; pulse width, 10nsec to 10msec. Two dc power supplies (Hewlett-Packard Model 6111A) having outputs of 0 to 20v and 0 to 1a are also provided.

The measurement module is a programmable AMC Model 1000 Waveform Analyzer which contains a digital differential voltmeter and a sampling oscilloscope. Voltmeter measurement ranges are ± 1 to 1000v with 100 μv resolution on the $\pm 1v$ scale. Sampling sweep speeds can be adjusted from 10nsec/div to 100nsec/div in decade steps.

Test results may be recorded (optionally) by adding interface circuitry between the 9001 and external data logging devices.

8. BECKMAN INSTRUMENTS, INC.
RICHMOND, CALIFORNIA
INTEGRATED CIRCUIT TESTER
MODEL 999

Performs static and functional tests on logic integrated circuits. The tests are set up by means of a pin board matrix.

Input voltages are 0 to 10v, currents 0 to 50ma. Readout is accomplished using an analog meter with voltage ranges 0 to 2.5v $\pm 2\%$ and 0 to 10v $\pm 2\%$ and current ranges of 1, 10, and 100ma. The tester can be connected to a digital voltmeter or an oscilloscope for external monitoring.

9. BIRTCHEER CORPORATION/INSTRUMENT DIVISION
MONTEREY PARK, CALIFORNIA
INTEGRATED CIRCUIT TEST SYSTEM
MODEL 800

The basic system can be used to perform static and functional tests. With the addition of a pulse generator module and an external oscilloscope, dynamic tests can be made on digital integrated circuits. Using a function generator, linear i.c. parameters can be monitored on the oscilloscope. (Twenty to twenty-five tests can be programmed on a matrix.)

Four voltage sources supply 0 to ± 1 , ± 10 , ± 100 v test voltages. Current supply ranges are 0 to ± 0.1 , 1.0, 10, and 100ma.

The readout module consists of an analog meter measuring 0 to 100v in 7 ranges and 1 μ a to 100ma in 10 ranges. A digital meter is available optionally.

10. BIRTCHEER CORPORATION/INSTRUMENT DIVISION
MONTEREY PARK, CALIFORNIA
INTEGRATED CIRCUIT TEST SYSTEM
MODEL 801

Similar to the Model 800, except that it provides rack space and connections to accommodate a digital voltmeter, oscilloscope, and signal source.

11. COMPUTER TEST CORPORATION
CHERRY HILL, NEW JERSEY
SEMI-AUTOMATIC INTEGRATED CIRCUIT ANALYZER
MICA-150

Performs static tests on a wide variety of integrated circuits having up to 40 pins. All test conditions are set up on two independent 11x40 programming matrices. Tests are sequenced from a push-button keyboard.

Voltage supplies provide 0 to 1, 10, and 100v; current supply ranges are 0 to 1, 10, and 100ma. A digital meter is used to measure the outputs from the device under test. Measurement ranges are: 99.99mv to 999.9v (5 ranges) and 0.9999 μ a to 999.9ma (7 ranges). An adjustable "soak time" control provides for thermal stabilization of the device under test prior to measurement.

As an option for dynamic testing, a pulse generator can be added to the MICA-150 to provide dual pulses, controllable in amplitude and reference level at repetition rates up to 5MHz.

12. CONTINENTAL DEVICE CORPORATION
HAWTHORNE, CALIFORNIA
MULTI-TERMINAL TEST UNIT
MODELS 9522-1 and 9522-2

Performs static tests on logic integrated circuits of up to 14 leads. Tests are set up using a 14 line connector located on the front panel.

Power supplies can consist of four voltage supplies (0 to ± 20 v) in the model 9522-1 or two voltage supplies (0 to ± 20 v) and one current supply (0 to ± 50 ma) in the model 9522-2.

An analog meter (1mv to 30v and 1na to 100ma) is used for readout. An external digital meter can also be employed.

13. CONTINENTAL DEVICE CORPORATION
HAWTHORNE, CALIFORNIA
MULTI-TERMINAL TEST UNIT
MODELS 9522-3 and 9522-4

Similar to Models 9522-1 and -2, except for the power supplies

which include two voltage sources (0 to $\pm 20\text{v}$) and one current source (0 to $\pm 200\text{ma}$) in the 9522-3, and four voltage sources (0 to $\pm 20\text{v}$ (3) and 0 to $\pm 15\text{v}$) in the 9522-4.

14. CONTINENTAL DEVICE CORPORATION
HAWTHORNE, CALIFORNIA
HI-SPEED INTEGRATED CIRCUIT TESTER
MODEL 9545

The Model 9545 is the basic unit of a test system designed to perform static tests on logic integrated circuits. It can be adapted to any one of several sequencing units available, manual or automatic. The tester is programmed by printed circuit cards to perform up to 20 tests (expandable to 100).

Power supply ranges are 0 to 1.0, 10, and 20v and 0 to 0.1, 1, 10, and 100ma. A digital voltmeter and/or go/no-go detector are used for readout.

15. CONTINENTAL DEVICE CORPORATION
HAWTHORNE, CALIFORNIA
SCAT 24

SCAT 24-7, 24-8, and 24-9 systems are designed to test all electrical parameters of multi-lead circuits with up to 50 leads. The systems may be tape, card, or disc programmed to perform the desired tests.

The type and number of power supplies can be varied according to the user's needs. The following are available:

Constant Voltage: 0.100 to 99.9v (3 ranges), 0.100 to 49.9v (3 ranges) and 10.0mv to 9.99v (3 ranges).

Constant current: 10.0 to 999 μa (2 ranges) and 1.00 to 999ma (3 ranges).

Constant current and voltage: 100mv to 49.9v (3 ranges); 100 μa to 99.9ma (3 ranges).

AC voltage: 0 to 100mv, 1.00mv, 10.0v, and 100v at 1, 10, 100 and 500kHz.

AC current: 0 to 10.0 μa , 100 μa , 1.00ma, and 10.0ma at 1, 10, 100, and 500kHz.

Test "soak time" can be programmed in 8msec increments up to a maximum of 8sec.

Test results are presented visually in a digital meter having the following measurement ranges: 0 to 1000v (5 ranges) and 0 to 100ma (8 ranges). Switching time measurements are made with a sampling oscilloscope.

Test data can be recorded using any one of several recording instruments adaptable to the SCAT-24 system.

16. CONTINENTAL DEVICE CORPORATION

HAWTHORNE, CALIFORNIA

SCAT 26

A modular system used to perform static tests on circuits having up to 48 leads. Several programming techniques are available, including printed circuit cards, manual peg board, card, tape and magnetic disc.

The type and number of the power supplies is optional. The following are available:

Voltage: 0 to 20v, 0 to 35v, and 0 to 250v.

Current: 0 to 150ma. Kelvin connections are used for all tests.

Test results can be read out visually (go/no-go lamps) or recorded using a card punch, printer, tape perforator, or typewriter.

17. CONTINENTAL DEVICE CORPORATION

HAWTHORNE, CALIFORNIA

SCAT 28

Performs tests on all dc and switching parameters of integrated circuits with up to 20 leads. Any number of tests can be programmed using a high speed paper tape reader.

Four constant voltage supplies provide voltage inputs of 0.1 to 1v, 1 to 10v, and 10 to 50v in 10mv, 100mv, and 1v steps, respectively. Current ranges are 10 to 100 μ a (1 μ a steps), 100 μ a to 1ma (10 μ a steps), 1 to 10ma (100 μ a steps), 10 to 100ma (1ma steps), and 100 to 150ma (10ma steps). A pulse generator provides 0 to 10v pulses at up to 10MHz (up to 20MHz with external sync); rise and fall times are 5nsec to 500 μ sec.

A digital meter and an oscilloscope are used for readout.

18. E-H RESEARCH LABORATORIES, INC.

OAKLAND, CALIFORNIA

DYNAMIC TEST SYSTEM

MODEL 4002

A modular system designed to make switching time and dynamic voltage level measurements on digital integrated circuits. Programs are read from mylar or paper tape into the Core Memory Storage Unit and are sequenced under operator control or by an associated automatic device handler.

Measurements of time intervals of transient waveforms are made with an E-H Model 142 Switching Time Converter. Dynamic voltage level measurements are carried out by means of a Model 153 Strobings Voltmeter. Two strobing voltmeters are supplied, one to monitor input stimuli to the device under test, the other to make output measurements of instantaneous voltage levels.

The measurement results are converted to digital form and compared against programmed upper and lower limits, resulting in a three digit numerical display of the measured value, together with a lamp display of go/no-go results. Measurement data may be recorded on a Kennedy Model 1400 Incremental Tape Recorder.

19. E-H RESEARCH LABORATORIES, INC.

OAKLAND, CALIFORNIA

DYNAMIC TEST SYSTEM

MODEL 4003

Performs dynamic tests on 14 lead logic integrated circuits. The test parameters for up to 81 sequential tests are programmed on punched cards and read by the system as needed. A second card reader can be added to increase program flexibility.

A Model 1139/1420 programmable pulse generator supplies pulses of +5 to +6v (<10nsec risetime) or +2v (<3nsec risetime) at 1kHz to 10MHz to the device under test.

Measurement results are digitized and compared against programmed upper and lower limits. Numerical results and high/go/low indication are displayed.

20. FAIRCHILD INSTRUMENTATION

SUNNYVALE, CALIFORNIA

AUTOMATIC TEST SYSTEM

SERIES 4000M

A magnetic disc programmed test system capable of performing functional and static tests on integrated circuits and wafers. The system can be programmed directly from a keyboard or from prepunched paper tape, or it can be controlled by a computer.

Two power supplies provide voltages of 0 to $\pm 90\text{v}$ (3 ranges). Constant current/constant voltage sources are available optionally. These can supply voltages of 0 to 25v (3 ranges) and currents of 0 to 1a (4 ranges) or voltages of 0 to 200v (3 ranges) and current of 0 to 166.5ma (3 ranges).

Other options include dynamic switching time tests and environmental tests. The latter are performed in a Model 4900 environmental chamber which operates between -65° and $+150^\circ\text{C}$. Provisions for multiplex operation and automatic handling and sorting are also available.

A digital meter and go/no-go lamps are used to display the test results. Measurement ranges of the digital meter are ± 0.1 to $\pm 100\text{v}$ (3 ranges) and $\pm 1.0\mu\text{a}$ to $\pm 100\text{ma}$ (5 ranges). Optional equipment is available for data logging.

21. FAIRCHILD INSTRUMENTATION

SUNNYVALE, CALIFORNIA

AUTOMATIC TEST CENTER FOR INTEGRATED CIRCUITS AND MODULES

SERIES 5000

Performs static and dynamic tests on digital and linear devices. Test programs consist of variable length sentences and may include commands for conditional and unconditional branching. The programs are stored in a 45 track magnetic disc memory with capacity for 3000 tests.

Two constant voltage/constant current supplies provide ± 1.6 , ± 16 , and $\pm 110\text{v}$ and ± 1.6 , ± 16 , and $\pm 160\text{ma}$. Power supplies of up to $\pm 1.0\text{a}$ and $\pm 200\text{v}$ are available optionally.

A digital meter and go/no-go display are used for readout. Meter ranges are ± 1.500 , ± 15.00 , and $\pm 100.0\text{v}$ and $\pm 1.500\mu\text{a}$, $\pm 15.00\mu\text{a}$, $\pm 150.0\mu\text{a}$, $\pm 1.500\text{ma}$, $\pm 15.00\text{ma}$, and $\pm 100.0\text{ma}$. Test results can be recorded if desired using a typewriter, tape punch, card punch, or tape recorder.

Dynamic tests require the use of the switching time test option which contains a digital time and voltage module (DTVM) for making measurements of pulse and ac waveforms between 1kHz and 300MHz.

22. FAIRCHILD INSTRUMENTATION

SUNNYVALE, CALIFORNIA

ARRAY TEST SYSTEM

SERIES 8000

A computer controlled, programmable test system capable of performing functional tests on digital circuits having up to 144 signal leads. The system can be interfaced with a wafer prober or other handling equipment. Programming is carried out by keyboard, paper tape, or magnetic tape.

Tests can be made in manual, semi-automatic, automatic, and cyclic modes. In the cyclic mode, a preselected series of tests is cyclically executed.

A digital meter (Series 7100) is used for readout and calibration. Oscilloscope readout is available optionally. A number of data logging devices can be added to the system.

23. FISHER-AKIN COMPANY

MANHATTAN BEACH, CALIFORNIA

AUTOMATED INTEGRATED CIRCUIT TESTER

MODEL 172

Programmed from a paper tape reader to automatically test 50 tray mounted 16-lead integrated circuits.

Four programmable power supplies provide the test conditions to the test tray. A reference power supply (stability better than 1%) is used to generate the reference voltage for the comparator limits.

If the value of the line under test is within the programmed limits, testing continues. If an out of tolerance condition is found, it is recorded by a printer.

24. 3M COMPANY
CAMARILLO, CALIFORNIA
AUTOMATIC TEST SYSTEM
SERIES 9400

A paper tape programmed system designed to test various types of multi-lead devices, including integrated circuits. The system can be adapted for automatic handling and classifying if desired.

The voltage supply contains four single-range voltage modules which provide voltages of up to 100v to the device under test. The current supply contains two current modules, each having the following ranges: 9.999 μ a, 99.99 μ a, 9.999ma, 99.99ma.

An Auto Data 5100 Series multimeter is used to read out the test results. Data logging output is available optionally.

25. MICRODYNE INSTRUMENTS, INC.
WALTHAM, MASSACHUSETTS
INTEGRATED CIRCUIT TESTER
MODEL 701

Performs static and functional tests on digital integrated circuits having up to 16 leads. Tests are set up by means of a prewired patch plug.

Two voltage supplies provide 0 to ± 10 v to the device under test. Pulse generator repetition rates are 5Hz and 10kHz; rise and fall times 50nsec.

An analog meter is used for readout. Voltage measurement ranges are: 1, 5, and 10v; current ranges: 1, 5, 10, and 50ma.

26. MICRODYNE INSTRUMENTS, INC.
INTEGRATED CIRCUIT TESTER
MODEL 710

A matrix programmed tester capable of performing static and functional tests on both digital and linear (operational amplifier) circuits. Maximum number of device terminals accepted is 16.

Voltage supply ranges are 0 to $\pm 10\text{v}$ and 0 to $\pm 25\text{v}$. Pulse generator repetition frequencies are 5Hz, 10Hz, 5kHz, and 10kHz, with 50nsec rise and fall times.

An analog meter (1, 5, 10, 50v and 0.1, 1, 5, 10, 50, 100ma) is used for readout.

27. MICRODYNE INSTRUMENTS, INC.
WALTHAM, MASSACHUSETTS
INTEGRATED CIRCUIT TESTER
MODEL 711

Performs static and functional tests on digital and linear integrated circuits having up to 36 leads. Tests can be set up by means of a 10 x 40 crosspoint matrix or with a prewired patch plug.

Two power supplies provide voltages of 0 to ± 10 , $\pm 25\text{v}$. Pulse generator frequencies are 5Hz, 100Hz, 5kHz, and 100kHz; rise and fall times, 50nsec.

A digital meter with voltage ranges of 1, 10, and 100v and current ranges of 1, 10, and 100ma is used for readout.

28. MICRODYNE INSTRUMENTS, INC.
WALTHAM, MASSACHUSETTS
INTEGRATED CIRCUIT TESTER
MODEL 715

A static and functional tester for both digital and linear integrated circuits. Can be programmed from a crosspoint matrix (10 x 40) or by means of a prewired patch plug.

Power supplies include four voltage sources with ranges of 0 to ± 1 , ± 10 , $\pm 25\text{v}$ and one current source with ranges of 1, 10, and 100ma. In addition, a swept voltage supply provides a sawtooth or triangular output at 1kHz. A pulse generator supplies signals of up to 10v at 10Hz, 100Hz, 10kHz, 100kHz, and 1MHz.

An analog meter is used to read out the test results. Voltage ranges: .025 to 100v (12 ranges). Current ranges: .025 to 100ma (12 ranges).

29. MICRODYNE INSTRUMENTS
WALTHAM, MASSACHUSETTS
INTEGRATED CIRCUIT TESTER
MODEL 716

Performs static and functional tests on digital and linear circuits. Tests are programmed on a 10 x 40 crosspoint matrix or by inserting a prewired patch plug into the tester.

Four constant voltage supplies provide 0 to ± 1 , ± 10 , and ± 25 v to the device under test. One current source supplies 1, 10, and 100ma. Pulse generator repetition rates are 10Hz, 100Hz, 1kHz, 10kHz, 100kHz, and 1MHz; pulse amplitudes: 0 to 10v. A swept voltage supply provides a +10v sawtooth or triangular output at up to 1kHz.

A digital meter is used for readout, with the following measurement ranges: 1, 10, 100v and 1, 10, 100ma.

30. MONITOR SYSTEMS, INC.
FORT WASHINGTON, PENNSYLVANIA
INTEGRATED CIRCUIT TESTER
MODEL 851

Performs static, functional, and dynamic tests on all commonly used integrated circuit types. Tests are set up using prewired program modules which are plugged into the tester.

Two voltage supplies provide test voltages of 0 to 15v (at 30ma and 50ma). A pulse generator supplies pulses of +2 to +6v at 1kHz, 10kHz, 100kHz, 1MHz, and 5MHz.

Test results must be monitored externally with a meter and oscilloscope.

31. OPTIMIZED DEVICES, INC.
PLEASANTVILLE, N. Y.
INTEGRATED CIRCUIT ANALYZER
MODEL IC 101

A matrix programmed tester for logic integrated circuits having up to 16 leads.

Four voltage supplies provide test voltages of 0 to ± 1 , 10, 30 and 100v. Provisions for up to four external forcing functions are included.

An analog voltmeter is used for readout. Measurement ranges are 0 to ± 1 , 3, 10, 30, and 100v. Current readout is available optionally. There are also connections for an external digital voltmeter.

32. OPTIMIZED DEVICES, INC.
PLEASANTVILLE, N. Y.
INTEGRATED CIRCUIT TEST SET
MODEL IC 102

A matrix programmed instrument capable of performing static and functional tests on digital integrated circuits. Twenty digital thumbwheel switches are used for programming the connection of up to 20 device pins to the desired forcing functions and ground.

Up to 8 plug-in forcing function modules can be included in the function module housing. Three types of modules are available: constant voltage: ± 1 , 10, 100v; constant voltage and high current: ± 1 , 10, 100v at up to 100ma; constant voltage and current. ± 1 , 10, 100v and ± 10 , 100 μ a; 10, 100ma.

An analog meter is used for readout with the following measurement ranges: 0 to ± 0.1 , 0.3, 1, 3, 10, 30, 100v and 0 to ± 0.1 , 0.3, 1, 3, 10, 30, 100 μ a, 0.3, 1, 3, 30, 100, 300ma.

Adapters with coaxial connectors for an external signal or pulse generator and/or high frequency oscilloscope are available as accessories.

33. OPTIMIZED DEVICES, INC.
PLEASANTVILLE, N. Y.
LOGIC CIRCUIT TEST SET
MODEL LT 101

Programmed by two plug-in circuit cards to perform static and functional tests on digital integrated circuits.

Two power supplies provide voltages of 0 to ± 10 v. Outputs from the device under test are compared to those from a reference device and a go/no-go output is obtained. In addition to this,

if the circuit under test draws current in excess of a preset limit the test sequence will be stopped.

Test results can also be monitored externally, using an oscilloscope or voltmeter.

34. OPTIMIZED DEVICES, INC.
PLEASANTVILLE, N. Y.
OPERATIONAL AMPLIFIER TEST SET
MODEL OPT-101

A self-contained instrument for test and evaluation of operational amplifiers. All test conditions are programmed with direct reading dials and switches on the front panel. Tests can be sequenced manually or automatically using an external sequencing device.

A precision power supply provides 0 to $\pm 50\text{v}$ at 50ma. For dynamic measurements, an external signal generator must be added.

An analog meter is available for readout. Test results can also be monitored externally with a digital voltmeter. An oscilloscope is needed for dynamic measurements.

Go/no-go and data logging outputs are available optionally.

35. OPTIMIZED DEVICES, INC.
PLEASANTVILLE, N. Y.
INTEGRATED CIRCUIT TEST SYSTEM
MODEL 5000

Performs high-speed testing of integrated circuits with both digital readout and go/no-go comparison. The test programs are stored in interchangeable magnetic discs, each holding up to 200 tests. The system can also be controlled by a digital computer.

The basic system performs static and functional testing, but options are available for dynamic measurements.

Digital power supplies provide voltages of 0 to ± 0.999 , ± 9.99 , and $\pm 99.9\text{v}$ and currents of 0 to ± 9.99 , ± 99.9 , $\pm 999\mu\text{a}$, ± 9.99 , and 99.9ma . A digital meter displays the test results. Voltage measurement ranges are: 0 to ± 0.9999 , ± 9.999 , and $\pm 99.99\text{v}$; current

ranges: 0 to 99.99na, 0 to 0.9999, 9.999, 99.99, 999.9 μ a and 0 to 9.999, 99.99ma.

A digital comparator performs go/no-go decisions and can operate in two modes: the first mode stops testing on any out-of-tolerance test; the second mode sequences through all tests and provides reject information to the data-logging equipment.

An option can be provided for device classification.

36. QUAN-TECH LABORATORIES, INC.

WHIPPANY, N. J.

INTEGRATED CIRCUIT NOISE ANALYZER

MODEL 2283-2181

A system for measuring noise in linear integrated circuits simultaneously at five frequencies from 10Hz to 100kHz.

The Model 2283 contains the power supplies (0 to ± 10 , ± 30 v) and controls for operating the instrument, and a test jig that accepts a plug-in circuit board containing the test socket, the gain determining, anti-oscillation, and phasing circuits. The frequency response can be selected by a front panel switch to be 5Hz to 125kHz or 500Hz to 125kHz.

The Model 2181 contains five separate filter channels and attenuators to measure noise (3, 10, 30, 100, 300, 1000, and 3000nv) and voltage spectral density at 10, 100Hz, 1, 10, and 100kHz.

37. REDCOR CORPORATION

CANOCA PARK, CALIFORNIA

IC TEST SYSTEM

MODEL 990/125

Performs static, functional, and dynamic tests on digital and linear integrated circuits with up to 16 pins. Test connections are made with a digit switch (Kelvin) matrix.

The standard complement of forcing functions for the 990 is as follows: three constant voltage supplies (0 to ± 1 , 10, 100v $\pm 0.1\%$ ± 0.5 mv fs), one constant current supply (0 to ± 1 , 10, 100ma $\pm 0.1\%$ ± 0.5 μ a fs), one swept voltage supply (same ranges as constant supply; sweep frequencies: 0.5, 5, 50, and 500Hz), one dual loads

module, and one pulse generator (1Hz to 10MHz from internal clock), $\pm 400\text{mv}$ to $\pm 10\text{v}$ output signal, and $< 10\text{nsec}$ rise time).

An analog meter is used for readout. Voltage ranges: 1, 10, 100mv, 1, 5, 10, 50, 100v; current ranges: 0.1, 1, 10, 100 μa , 1, 10, 100ma, and 1a. An external scope is needed for dynamic measurements.

38. REDCOR CORPORATION
CANOGA PARK, CALIFORNIA
IC TEST SYSTEM
MODEL 990/135

Similar to Model 990/125, but with digital meter readout. Voltage ranges: 10, 100mv, 1, 10, 100v; current ranges: 1, 10, 100 μa , 1, 10, 100ma, 1a.

39. SIGNETICS CORPORATION
SUNNYVALE, CALIFORNIA
IC TESTER
MODEL 1100

Programmed with one plug-in circuit card to perform static, functional, and dynamic tests on digital integrated circuits with up to 16 leads. The unit is adaptable to automatic handling equipment.

Each plug-in program card contains a good device of the type to be tested plus discrete components required to establish loading conditions.

The standard series of tests consists of the following sequences: continuity (available only for test heads with Kelvin connections), orientation and power dissipation, functional test, noisy immunity test, and toggle rate test (with 5MHz crystal-controlled clock).

Test results are displayed as go/no-go by front panel lamps, one for each test sequence.

40. TERADYNE, INC.

BOSTON, MASSACHUSETTS

ANALOGICAL CIRCUIT TEST INSTRUMENT (ACT I)

MODEL J133

Performs static and functional tests on digital integrated circuits with up to 16 leads. Tests are programmed using two plug-in printed circuit cards; one for all the devices within a particular family or grade, the other for the individual device to be tested.

In its automatic testing sequence, the J133 establishes all the desired combinations of ones and zeros on all device inputs at the appropriate levels in the desired sequence. For each combination, it measures the significant voltages or currents at all inputs, outputs and the supply. Forcing function ranges are 2 to 8v and 0 to 50ma.

Test results are displayed by go/no-go lamps which indicate the input situations which result in failed tests and the expected outputs for those combinations.

The tester can process as many as 7000 devices per hour with automatic handling equipment, and can perform tests at the wafer level.

41. TERADYNE, INC.

BOSTON, MASSACHUSETTS

COMPUTER OPERATED CIRCUIT TEST SYSTEM

MODEL J259

A computer controlled test system for static and functional testing of digital integrated and hybrid circuits. It can be used for classification, inspection, data logging and evaluation. Multiplex operation is available optionally.

The system comprises three major units: a test instrument made up of modular elements, a general purpose digital computer, and one or more software packages for programming the digital computer. Each software package enables the user to perform a different combination of classification, data logging, evaluation, and statistical functions.

A dual buffered D-A voltage source (Model M323) provides the stimuli and biases of 0 to ± 1.599 , ± 15.99 v. Voltage and current stimuli (0 to ± 1.599 , ± 15.99 v and 0 to $\pm 119.9\mu$ a, ± 1.199 , ± 11.99 , ± 119.9 ma) are supplied by a Model M351 digital buffered measurement system which also measures voltage and current in the following ranges: 0 to ± 1.599 , ± 15.99 v; 0 to ± 1.199 , ± 11.99 , $\pm 119.9\mu$ a,

± 1.199 ± 11.99 , $\pm 119.9\text{ma}$. Kelvin connections are used for all measurements.

42. TEXAS INSTRUMENTS, INC.
HOUSTON, TEXAS
INTEGRATED CIRCUIT TESTER
MODEL 659A

A go/no-go instrument capable of making up to 36 sequential dc tests on integrated circuits having up to 14 active leads. Kelvin connections are provided.

Programming is accomplished by inserting prewired circuit boards for the following functions: bias, timing, limits, logic, and sorting logic.

Two test power supplies provide 0 to 20v and two others provide 0 to 50v. Individual test times may be as long as 5sec, and a "hold" switch allows for continuous operation of any test.

Lamps on the front panel indicate tests failed. Internal sorting logic provides for device classification.

43. TEXAS INSTRUMENTS, INC.
HOUSTON, TEXAS
INTEGRATED CIRCUIT TESTER
MODEL 659B

Specifications and operation are essentially the same as those for the 659A except that connections and space are provided to drive a digital voltmeter (supplied by the user). Also, ten power supplies are available. Two have a fixed output of 30v. The remaining eight can be chosen from the following options: 0 to 18v, 0 to 36v, 0 to 50v, and 0 to 5v. The last one has 1mv (0.01%) regulation.

44. TEXAS INSTRUMENTS, INC.

HOUSTON, TEXAS

INTEGRATED CIRCUIT TESTER

MODEL 662

An automatic instrument for evaluation, quality control, and incoming inspection of integrated circuits. Up to 36 static tests can be programmed, and the results displayed and recorded. Kelvin connections are used.

Test bias conditions and duration are programmed by printed circuit boards. In the manual mode, sequencing and selection of tests to be performed is accomplished by front panel control.

Two fixed power supplies provide 30v to the device under test. In addition, eight programmable supplies are available, selected from the following: 0 to 18v, 0 to 36v, 0 to 50v, and 0 to 5v (1mv regulation).

Test results can be displayed by a digital meter with the following readout ranges: 1, 10, 100v and 100na, 1, 10, 100µa, 1, 10, 100ma.

When the optional comparator is used, test results are recorded on a typewriter, card punch, or digital printer.

45. TEXAS INSTRUMENTS, INC.

HOUSTON, TEXAS

INTEGRATED CIRCUIT TEST SYSTEM

MODEL 668

An automatic system capable of performing static and functional tests on integrated circuits with up to 16 leads. A single system can accommodate several probe stations.

Programs are punched on paper tape which is formed into a loop for repeated operation. Also, a computer can be used for program input and data output.

Two programmable dc voltage sources and one current source are provided. Voltage ranges: ± 3.999 and ± 39.99 v. Current ranges: 0.1µa to 500ma (9 ranges).

Test results are displayed as go/no-go signals.

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13. ABSTRACT

This report presents a brief discussion on the various instrments in use today for electrical testing of integrated circuits. A tabulation of commercially available manual and automatic testers is included.

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