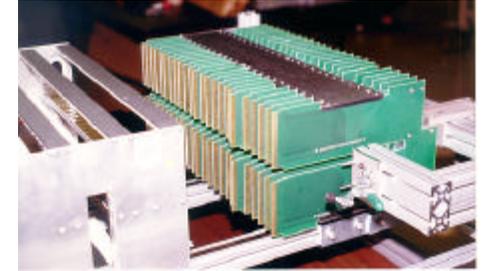


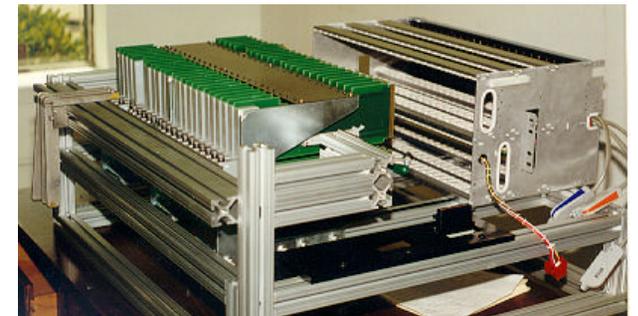


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Level IV Backplane Test Systems *by* Testronics





Test Strategy Goal:

Provide a next generation test capability to address the more advanced backplanes and shelf / rack assemblies that are starting to be produced.

How: By offering a high throughput, high reliable test platform which will bridge the gap between continuity testers and In-Circuit testers.

Requirements:

High throughput
Increased fault coverage
GenRad/Teradyne like capability
Competitive price

Expanded measurement ranges
High pin count capability
Windows '98 & Networking
High Reliability product interface / fixture



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About Testronics

- Started in 1982
- Privately held
- Located in North Dallas suburb of McKinney
- Purchased 40,000 sq. ft. facility & 4 acres
- Global network of sales & service groups
- Over \$ 50,000,000 worth of test equipment installed





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Testronics Backplane Test System Users

Since 1993, over 200 systems have been installed.

Users of Testronics Backplane tester systems:

Sanmina

Elexsys (Sanmina)

Altron (Sanmina)

Alcatel

CMAC

Kentrox

Dovatron (DII)

AT&T

Solectron

Hadco

ADC

Fujitsu

Otelco

IMS (Celestica)

Tyco

AMP Packaging (Tyco)

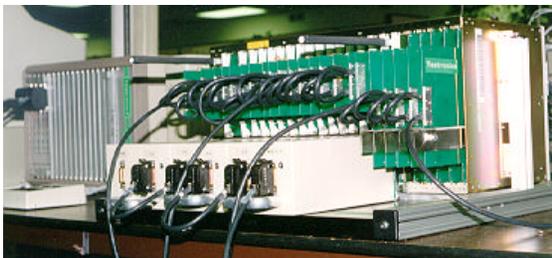
Sigma Circuits (Tyco)

Cuplex (DDI)

Paragon

Tri-Star

LeeMAH





Testronics 400 Series Level IV Backplane Test System

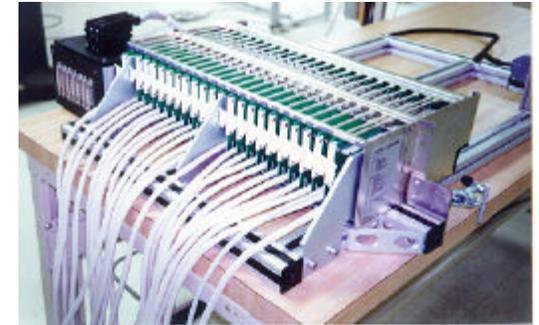
- Testronics became involved with backplane testing in 1987 with Alcatel being our first true backplane customer. The system was our model 103 Continuity Analyzer and had 12,288 test points and was programmable up to 600 volts.
- The 103 product family met all of the test requirements for level III testing, but fell short when testing the more advanced level IV products.
- The model 405 Manufacturing Defects Analyzer / Analog In-Circuit Test System was introduced in 1993, and has since been extremely successful with loaded board manufacturers as an inexpensive alternative to In-Circuit testing.
- The 401 Level IV Backplane Test System uses the same electronics and software as our model 405/406 Manufacturing Defects Analyzer/Analog In-Circuit Test System

Typical Backplane Test System Configurations

Stand alone electronics connected to paddle cards through discrete ribbon cables

406-LV:

- Represents about 35% of all systems.
- Typical point count is between 6k points - 20k points.
- These systems are normally set up and dedicated to a few high run part numbers.



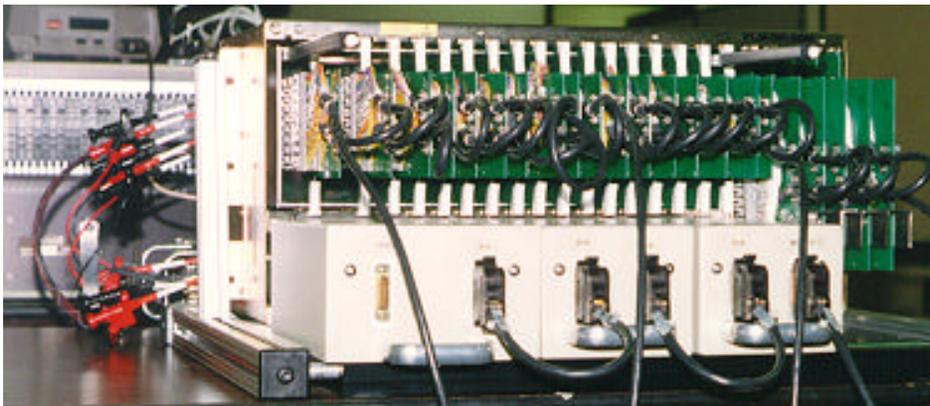
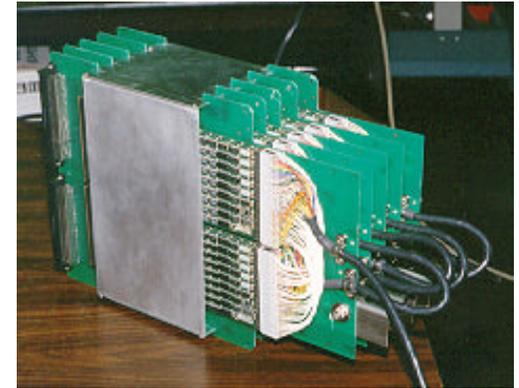
We do have a few customers connecting dedicated vacuum fixtures to the electronics. This is still for high run counts, but the throughput is much greater than paddle cards. Test / interface reliability is also much greater.

Typical Backplane Test System Configurations

Daisy Chain / Active Paddle Cards

406-D/C:

- Represents about 20% of all systems.
- Typical point count is between 10k points to 50k points.
- This application is also used on high run jobs.



Most of the customers using this application are testing both the backplane and card cage combined, (shelf).

Typical Backplane Test System Configurations

Pneumatic Press using Pogo style clam-shell fixtures

401:

- Represents about 45% of all of the installed systems.
- Normal pin count is between 10k points and 20k points, however we are seeing a few 20k point systems being installed.
- The press / pogo pin fixtures provide the ability to run small lot jobs quickly



Normal throughput / cycle time for a 10k point backplane is less than 2 minutes. New job setup takes about 5 minutes.





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Testronics 400 Series Level IV Backplane Test System Features

Electrical Features:

Greater measurement capability of any high pin count tester, >10k points

6 wire matrix

4 wire Kelvin

Unlimited Guard capability

Complex Impedance measurements

Quadrature A/C Capacitance & Inductance measurements

D/C Capacitance feature for large capacitors

Software based calibration

Automatic IC characterization

External IEEE instrumentation functions inside of test program



Testronics 400 Series Level IV Backplane Test System Features

Electrical Specifications:

Resistance:	.01 ohms to 100 Mohms
Capacitance:	10 pFarads to 5 Farads
Inductance:	10 uHenrys to 10 Henrys
Diodes:	Vf and Delta Vf programmable from .001 volts to 10 Volts
Zeners:	Vf, Delta Vf, Vz programmable to 10V (100V optional)
I/Cs:	Vf and Delta Vf programmable from .001 volts to 10 Volts
Opens:	.01 ohms to 100 Mohms
Shorts:	.01 ohms to 100 Mohms
Voltage:	.001 volts to 10 volts, (100 volts optional)
Current:	250 nAmps to 5 mAmps (100 mAmps Guard)

Typical accuracy: 2% (depending on circuit)

Enhanced accuracy: .1% (depending on circuit)



Model 401 Level IV Backplane Test System Features

The 401 does not damage the backplane's active components and I/Cs:

The electronics used are identical to our model 406 Analog In-Circuit test system which is used to test loaded circuit card assemblies.

Many backplanes today have active components such as diodes, voltage regulators, EPROMs, ASICs, and other ICs. Most continuity testers do not control the compliance voltage when they are making a measurement, thereby turning on the active device. Damage can occur if too much current is applied. This problem is most frequent during the learn process.

The Testronics system controls both the voltage and current very tightly so that under no circumstances does the voltage or current exceed programmed levels.



Testronics 400 Series Level IV Backplane Test System Features

Complete “VECTORLESS” test utilities

The 400 Series systems use Vectorless test utilities to provide manufacturing test coverage on ICs.

An IC diode characterization technique was developed for testing of:

Wrong IC installed

IC installed backwards

Missing IC

Open or unsoldered IC leads on non bussed pins

To check for open leads on bussed ICs, we implemented HP’s TestJet technology. TestJet is a patented method of checking for open IC pins and connector pins by measuring small differences in capacitance. We are fully licensed by HP to offer this option.



Testronics 400 Series Level IV Backplane Test System Features

Buss level digital I/O

Also available is a digital I/O module which provides the ability to read and write digital bits. 24 bi-directional channels per module and multiple modules can be connected together. Under test program control, bits can be sent out, or read back in. Bit out, word out, bit compare and word compare are all supported.

Along with the digital capability, 24 channels of external relay control is also provided. The user has access to both sides of 24 individual relay contacts which can be used to control secondary, external functions and devices. These relay contacts are under complete test program control. Contacts are Normally / Open, however, there are 5 designated as Normally /Closed.



Testronics 400 Series Level IV Backplane Test System Features

External IEEE Instrument Integration

The 400 series uses an open architecture buss which provides the ability to extend the capabilities by adding additional external instruments and power supplies. The measurement buss is completely accessible to the user, and is 8 analog lines wide.

A complete set of IEEE and *.exe function calls are standard in the 401 software programming package.

The architecture can simultaneously support different switch matrix card configurations to provide increased flexibility.

- 6 wire solid state matrix

- 6 wire solid state + 1 disconnect relay matrix

- 6 wire relay based matrix



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Testronics 400 Series Level IV Backplane System Software

Software Features

- Next generation 32 bit Windows '95 / '98 user interface.
- MS Word is the standard editor. Can also use “Brief” or any one of your choosing.
- Automatic learn of loaded backplane assemblies, while compensating for capacitors and resistors.
- Interactive debug screens and on-line editing
- Many tools developed specifically to support loaded backplane testing



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Testronics 400 Series Level IV Backplane System Software

Software Features

- Testronics has included MS Word macros to allow pull down insertion of test actions and format functions
- A planned enhancement to WinTOS is to use MS Excel to create SPC and management reports
- WinTOS uses MS Access and the MS jet database to import test program data from external sources.
- WinTOS is Soundblaster compatible and uses external speakers to audibly say the pin number when the user touches the external debug probe to a test point during the scan pin utility



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Testronics 400 Series Level IV Backplane System Software

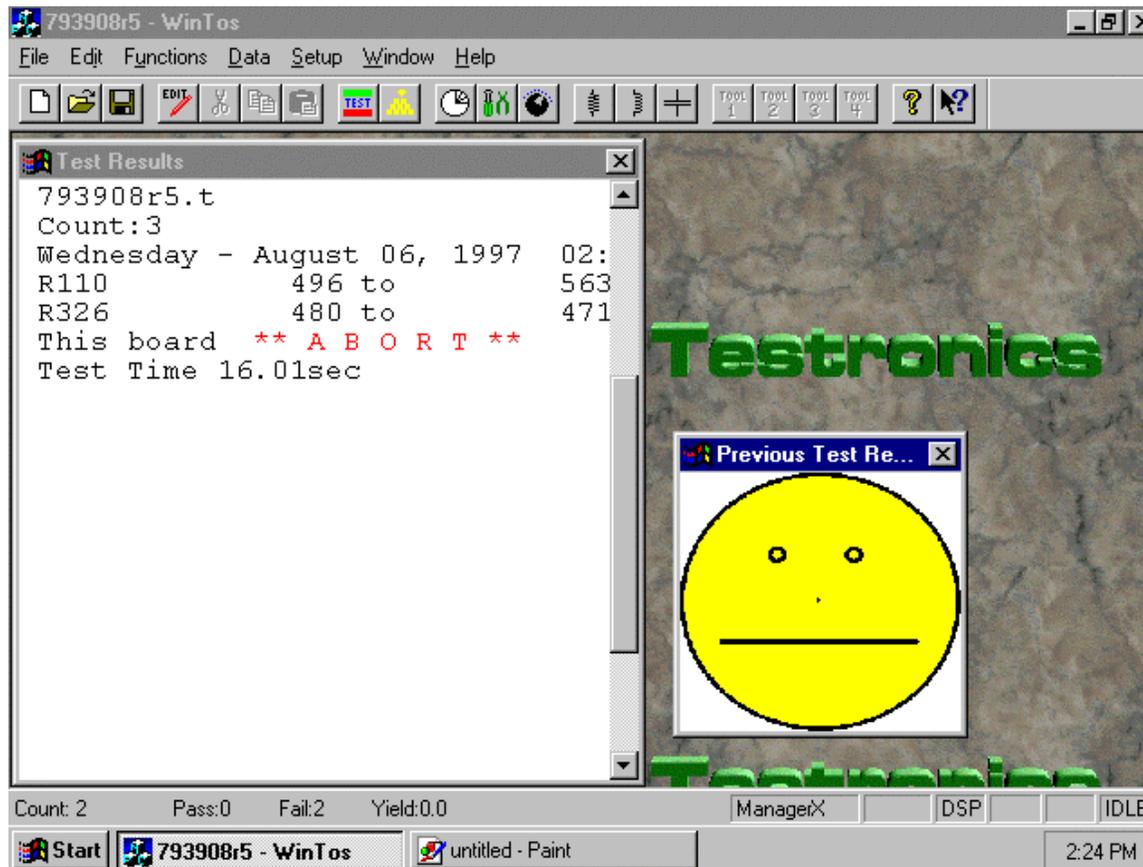
The screenshot shows a window titled '793908r5 - WinTos' with a menu bar (File, Edit, Functions, Data, Setup, Window, Help) and a toolbar. The main display area has a textured background with the word 'Testronics' in green. Below this is a 'Test Results' window with the following data:

Component	Value 1	Value 2	Value 3
C006	113 to	76	1.061nF
C029	563 to	576	8.86nF
C089	40 to	66	8.87nF
C096	499 to	498	8.67nF
C116	500 to	563	8.74nF
C170	325 to	76	88.4nF
C198	338 to	339	8.69nF
C201	336 to	76	7.88nF

Below the table, it says 'This board F A I L' and 'Test Time 33.16sec'. At the bottom of the window, there are buttons for 'ManagerX', 'DSP', and 'IDLE', and a status bar showing '2:19 PM'.

Typical Test Results Screen

Testronics 400 Series Level IV Backplane System Software



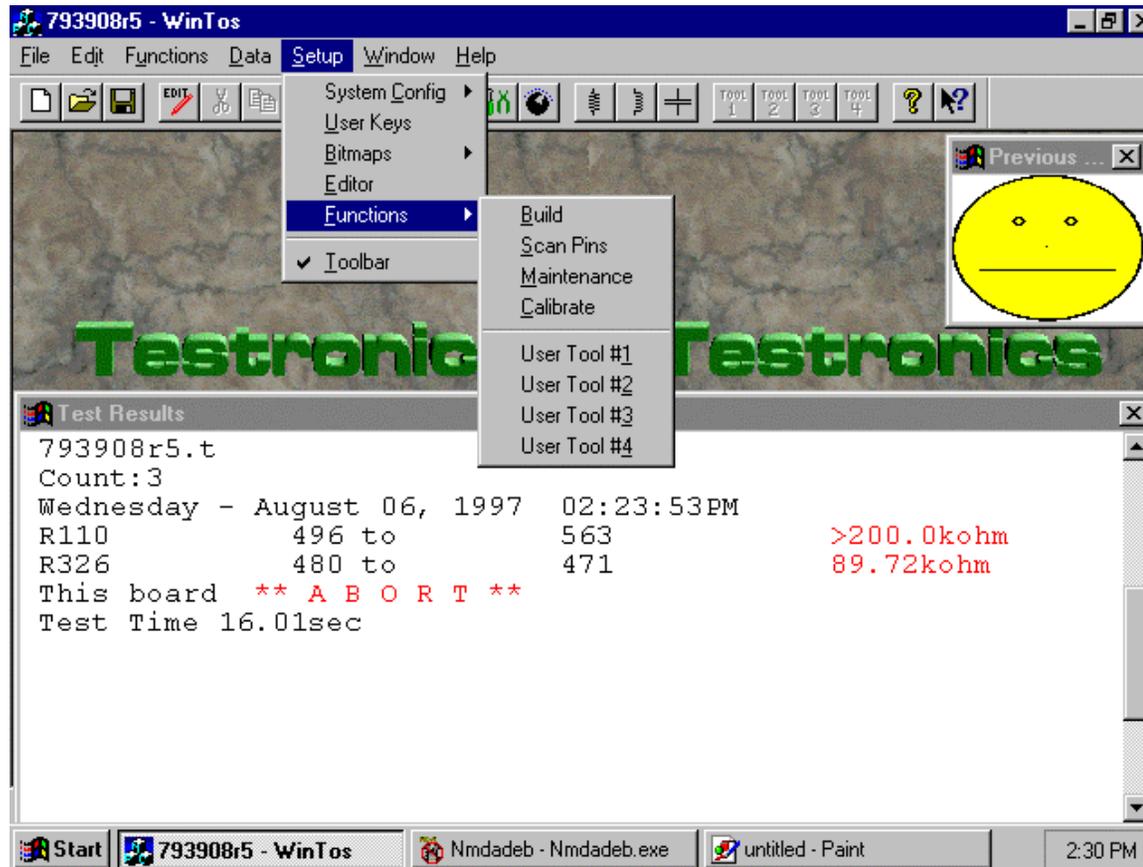
Resized Test Results
Screen with Test Status Bit
Map indicating test status



Testronics

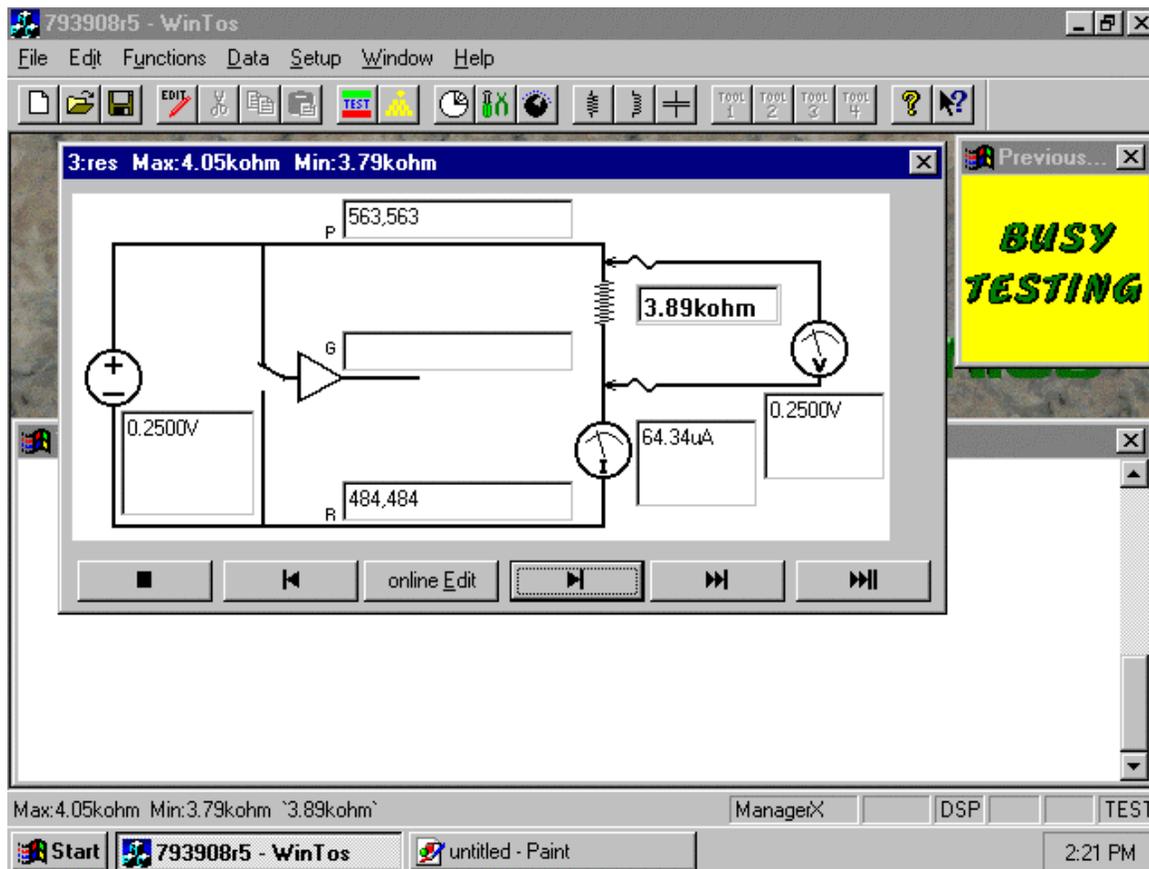
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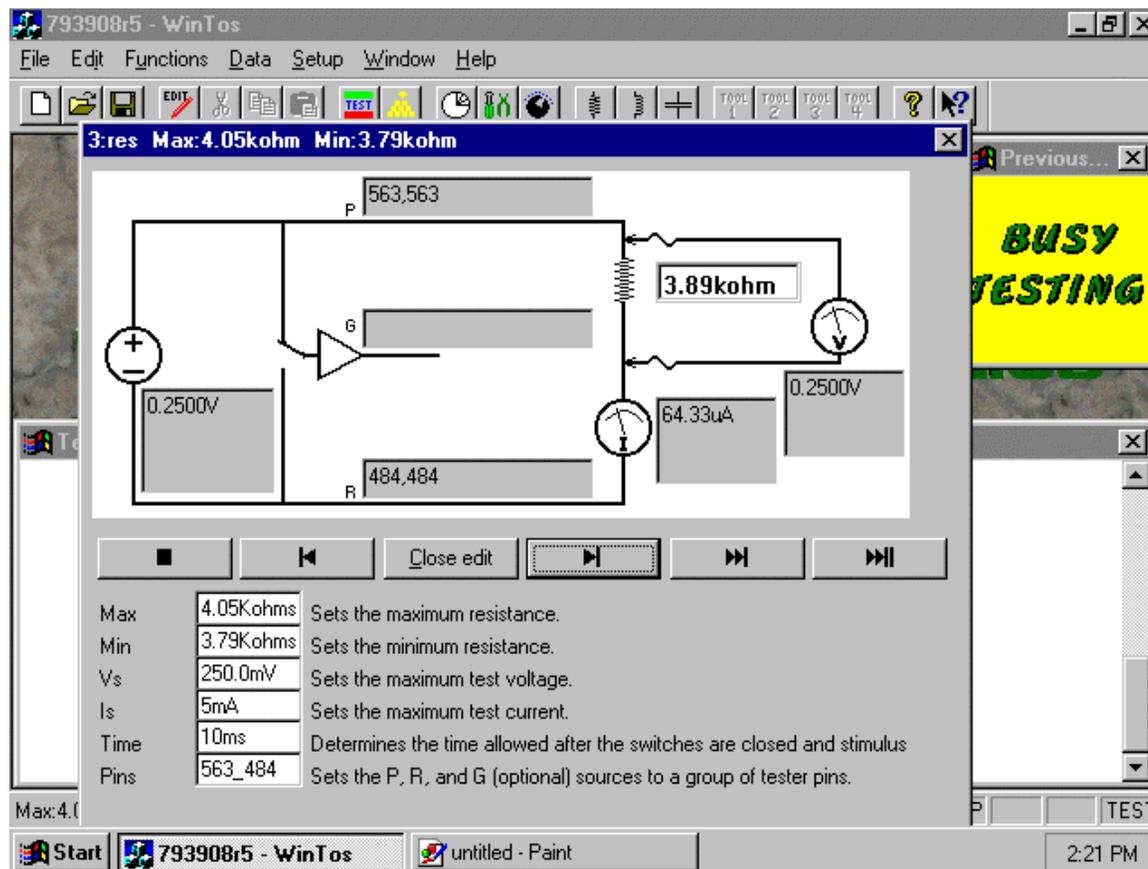
Screen showing Pull
Down Menu Items

Testronics 400 Level IV Backplane System Software



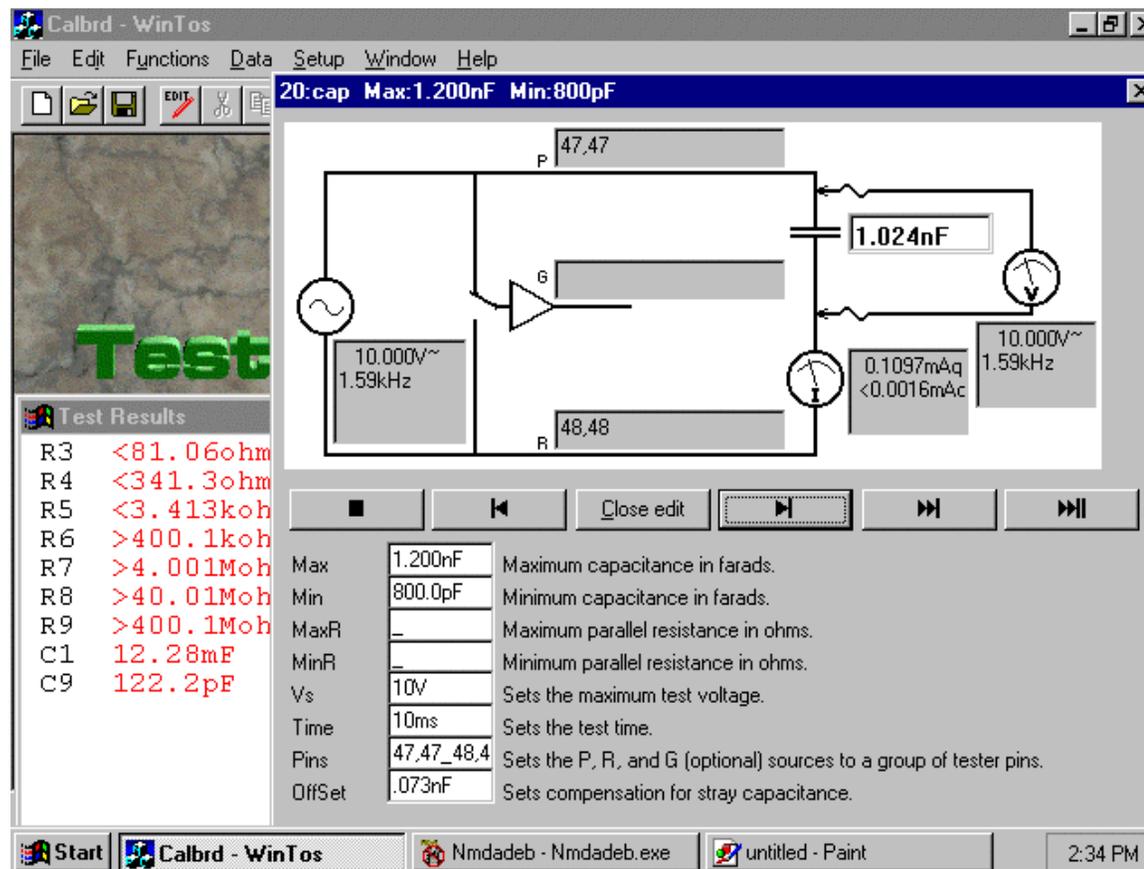
Graphical Measurement
Screen in Step Mode

Testronics 400 Level IV Backplane System Software



Graphical Measurement Screen
On-Line Edit / Real Time
Resistor Measurement

Testronics 400 Level IV Backplane System Software



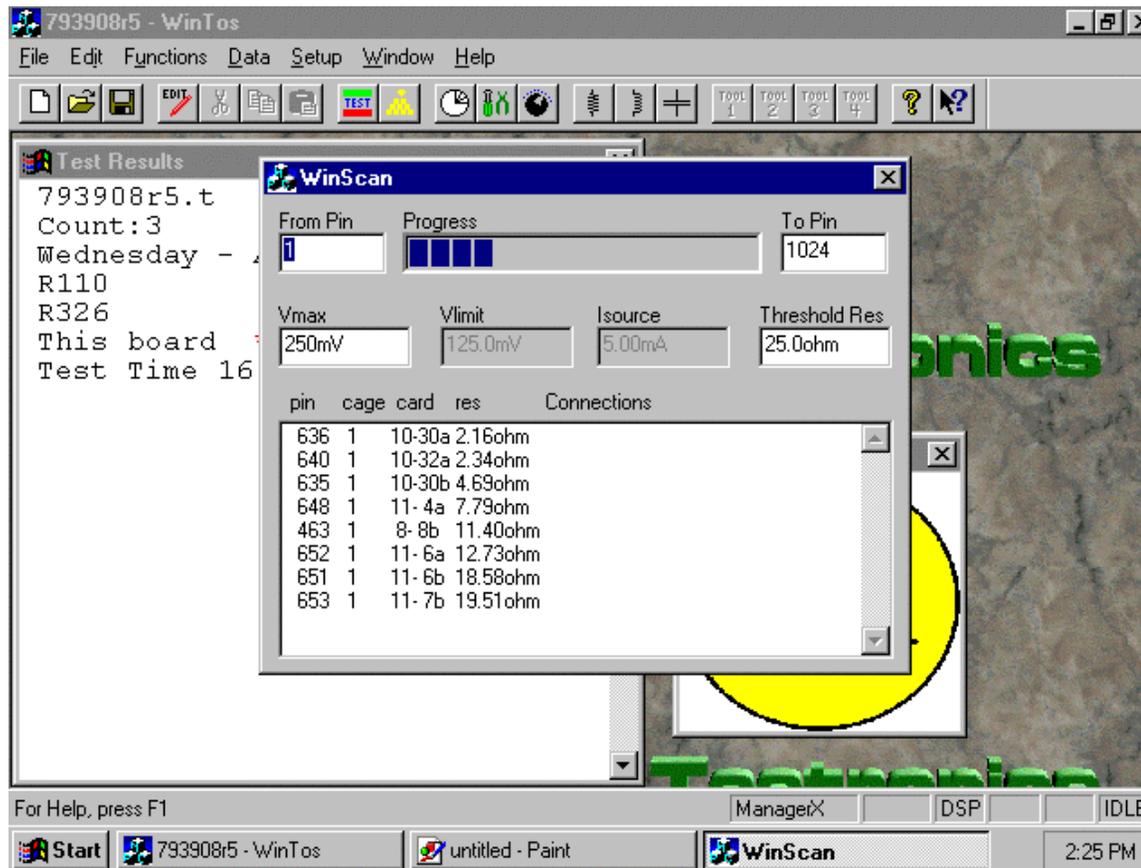
The screenshot shows the Calbrd - WinTos software interface. The main window displays a circuit diagram for a test setup. The diagram includes a 10.000V~ 1.59kHz AC source connected to a network of components. A central component is labeled 'G' (conductance). Other components include a 1.024nF capacitor and a 0.1097mAq <0.0016mAc current source. The circuit is connected to a load with a resistance of 48.48 ohms. The test results are displayed in a table on the left side of the interface.

Component	Value
R3	<81.06ohm
R4	<341.3ohm
R5	<3.413koh
R6	>400.1koh
R7	>4.001Moh
R8	>40.01Moh
R9	>400.1Moh
C1	12.28mF
C9	122.2pF

Below the test results, there is a configuration table for the test parameters:

Max	1.200nF	Maximum capacitance in farads.
Min	800.0pF	Minimum capacitance in farads.
MaxR	_	Maximum parallel resistance in ohms.
MinR	_	Minimum parallel resistance in ohms.
Vs	10V	Sets the maximum test voltage.
Time	10ms	Sets the test time.
Pins	47.47_48.4	Sets the P, R, and G (optional) sources to a group of tester pins.
OffSet	.073nF	Sets compensation for stray capacitance.

Testronics 400 Level IV Backplane System Software



Scan Pin utility with audible voicing of pin number



Testronics 400 Level IV Backplane System Support

Calibration

- Software based calibration with external standards. An optional diagnostic fixture is available to facilitate quick calibration and repair of the system.

Maintenance

- A complete set of electrical and mechanical spares kits are available. Electrical spares kit costs about \$ 8,000 while the mechanical spares kit costs about \$ 10,000.
- Any board returned to the factory after the warranty period will be immediately exchanged on a next day, Fed - Ex basis, (if outside the DFW area). Current exchange / repair costs for most boards is \$ 690 per board.



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Testronics 400 Level IV Backplane System Support

Training

- Free, unlimited training during the first year at our Factory in McKinney, Texas. This covers as many people as you wish to send as well as how often you send them. Currently, after the first year, there is a single training charge applied regardless of the number of people attending the class.



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Testronics 400 Level IV Backplane System Support

Warranty

- Warranty period is for one year after shipment and covers all parts and labor to repair any item returned to Testronics.

Software

- Free software updates for the life of the equipment. There are no charges for software upgrades.

Telephone Support

- Free, unlimited telephone support is standard feature of all of Testronics' systems.

Model 401 Pneumatic Press Backplane Test System Fixturing

The fixturing used on the 401 system has been developed to provide high reliability testing as well as high throughput.

There are three primary sources for this style fixturing:

Testronics

Everett / Charles

AQL

Southwest Test



Some top and bottom access is required on almost every fixture we have built.

High density 2mm connectors pose no problems.



Model 401 Pneumatic Press Backplane Test System

Fixturing Notes

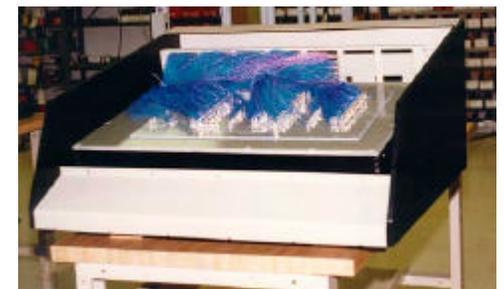
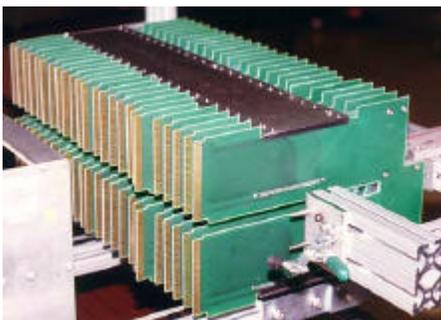
A few of our customers elect to test isolated, single pins for presence. This is accomplished by placing a test probe on the bottom and the top of the connector pin simultaneously, then measuring continuity between the two pins. This technique detects isolated, single pin presence, but adds to the fixture cost by about 20%.

Switch probes are used to verify connector orientation. They are normally positioned over the key slot. Then if the connector is in backwards, the switch probe is engaged by the shell.

Our typical fixtures average between 4k and 10k test points, however, we see them as large as 20k.

Specialized Fixturing

Over the years, Testronics has developed many innovative fixturing solutions to meet a wide range of applications.





Model 401 Pneumatic Press Backplane Test System

Advantages / Disadvantages

Advantages:

- Level IV test capability
- High test throughput
- Very fast fixture changeout
- True Analog In-Circuit / MDA testing
- Tester will not damage sensitive active devices
- Vectorless testing on ICs
- Pogo pin / clam shell fixtures
- 100% test coverage, single pass
- Highest reliability backplane fixturing technique



Model 401 Pneumatic Press Backplane Test System

Advantages / Disadvantages

Disadvantages:

- Some customers want paddle card testing
- Some customers may not want to pay for the fixtures
- Fixturing costs may be too high for low volume jobs
- Applicable only for backplane testing. Shelf testing must use paddle cards



Model 406LV Backplane Test System

Advantages

- Has 64 pin output connectors for use with paddle cards
- Initial System costs are lower without the press
- Same electronics and software as the 401 press system
- Electronics can be integrated later on into the 401 press as need for high throughput increases
- Paddle card fixturing is lower cost than pogo pin
- A 10k test point system can be split into two 5k systems by adding an additional control card cage and computer at minimal cost

Disadvantages

- Longer set up time
- Slower throughput



Testronics 400 Level IV Backplane System Summary

- Very high throughput capability as electrical tests are stable, repeatable, and accurate
- Open Architecture allows for external instrument integration to enhance measurement capabilities
- Testronics has many years of backplane test experience and is the primary supplier to most of the U.S. based Backplane Manufacturers
- System meets the test requirements of next generation backplanes as it bridges the gap between Continuity testers and In-Circuit testers
- Competitively priced