Analyst ems

Open Platform Board Test System

Features

- Available TestJet Technology*, Boundary-Scan, and MultiWriter† part programming
- Fully-integrated CheckSum test system software environment
- Built-in SPC measurement tools; easily integrated into factory data system
- Easily integrated with CheckSum Fixture Systems

The ***Analyst ems*** is designed to test most single or doubled-sided SMT/through-hole circuit assemblies. It can perform effective power-down testing for most analog or digital assemblies being manufactured today.

Dual level probing and optional power-up functional test capability is ideally suited for lower frequency analog assemblies with some digital content.

The ***Analyst ems*** can test the entire assembly and individual components without power applied. Using sophisticated measurement techniques such as DC or complex-impedance measurements in conjunction with multi-point guarding, this system provides the capability to find the majority of faults such as shorts, opens and wrong or incorrectly installed components. By finding the majority of faults while the board is in a safe unpowered mode, and with very specific fault diagnostic messages, faulty boards can be repaired quickly.

The ***Analyst ems*** system can include a mechanical, pneumatic or vacuum fixture system.

CheckSum can ship the system to you complete with a ready-to-use test fixture and test program for one or more of your UUTs. You can use CheckSum's fixturing division to handle all of your fixturing and programming needs; or you can modify or add UUTs yourself or with the use of third-parties.

Power-Down Test Capabilities

For component in-circuit testing, the System provides effective tools to find most faults. These measurements are made with signal injection/measurement, but without the UUT powered on. Measurements are taken at high speeds using a solid-state multiplexing system. Most complete tests are under ten seconds.

Opens/Shorts

The System can test from each point to each other point to detect faults. Open/short thresholds are typically in the 10Ω range, but can be programmed over the range of 2Ω to 50KΩ. Continuity tests can use either 1mA, 100μA, 10μA, or 1μA source current. Specified pairs of points can be designated as "no-cares" to allow the most effective diagnostics or to deal with points that are near threshold values.

Resistance Measurements

The System provides the ability to measure from 0Ω up to 19MΩ using various techniques to optimize the measurement effectiveness. You can choose between using a constant-current source (0.1μA to 10mA), a DC constant-voltage source (0.02V to 2V full range), or AC complex-impedance measurements over the range of 100Hz - 1KHz. Resistance tests can be used with external sense (4-wire Kelvin measurements), and in conjunction with multi-point guarding to isolate individual components. Guard currents up to 100mA are available. Up to 16 distinct measurement and stimulus functions can be active during a single measurement.

Capacitance Measurements

The System provides the ability to measure from a few pF up to 20,000μF. You can choose between using a constant-current pulsed source (1mA to 10mA), or AC complex-impedance measurements over the range of 100Hz – 100KHz. Capacitance tests can be used with external sense (4-wire Kelvin measurements), and in conjunction with multi-point guarding to isolate individual components. Guard currents up to 100mA are available. Up to 16 distinct measurement and stimulus functions can be active during a single measurement.

Inductance Measurements

The System provides the ability to measure from a few μH up to 1000H. Measurements are made by using complex-impedance measurements with stimulus frequencies between 100Hz and 100KHz and full-range amplitudes of .02V to 2V. Inductance tests can be used with external sense (4-wire Kelvin measurements), and in conjunction

†MultiWriter Technology is protected under U.S. Patent No. 7,802,021. **TestJet Technology is protected under U.S. Patent Nos. 5,124,660 and 5,254,953.*

with multi-point guarding to isolate individual components. Guard currents up to 100mA are available. Up to 16 distinct measurement and stimulus functions can be active during a single measurement.

Voltage Measurements
For UUTs with batteries, the DC voltage up to 10V can be measured. An optional DMM capability measures up to 250V.

Transistors
Transistors can be tested as two diode junctions, or tested for Beta while in-circuit. The Beta test can help determine proper insertion polarity for transistors that can be installed backwards, but with the base still in the middle. This type of fault cannot typically be detected with diode testing of the junctions.

FETs
FETs can be tested for turn-on voltage. By sweeping a voltage into the gate while monitoring the Source/Drain impedance, the FET can be checked for proper orientation and operation.

Opto-Isolators
Opto-isolators can be tested by sourcing into the input leads while measuring the output impedance. By testing each device in the on and off state, high confidence is obtained.

Relays
Up to 24V with up to 100mA can be used to actuate relay coils. This allows testing of contacts in each state to ensure that the contacts are not shorted, and that the coil is operational.

Diodes
Diodes are tested by providing a constant current source (0.1µA to 100mA), then measuring the forward voltage drop, which is typically in the 0.6V to 0.8V range. This test ensures that the diode is installed, is in the proper orientation, and is not open or shorted.

Zener Diodes
Zeners are tested by providing a constant current source (0.1µA to 100mA), then measuring the forward voltage drop. Measurements up to 50V can be performed. This test ensures that the zener diode is installed, is in the proper orientation, and is not open or shorted. Zeners that cannot be brought to their full voltage due to current or voltage limiting can be tested as normal diodes or in some cases can be tested during the power-up stage.

CheckSum 12KN Dual Level Fixture System

LEDs
LEDs are tested like signal diodes, but normally have higher forward voltage drop. Special light-sensing probes can be added to customized test fixtures to detect brightness and color of LEDs and incandescent lamps.

Transformers
Transformers are typically tested for dc resistance of each coil to detect presence. Coils can also be tested for inductance, and a polarity test can be used to ensure that each coil is wired correctly. This can detect faults inherent to hand-loading of transformers with wire leads.

IC Presence/Orientation
IC's are tested by using the ICs test. This test measures each IC pin to specified pins such as VCC, VSS or VDD, checking for the presence of

the IC's internal protection diodes. This test detects most faults such as shorted pins, open pins or mis-clocked or wrong ICs. In some cases, faults may not be detected if the IC pins are bussed or devices of similar pin-topology are interchanged.

IC Pin Connections

With the use of TestJet Technology, the System can detect opens to IC pins, even though the pin is bussed to other ICs. This advanced technology (licensed to CheckSum by Agilent), uses a sophisticated software/hardware algorithm to measure the minute capacitance between the PCB and the IC for each pin. If a pin is open, the capacitance significantly decreases. This technology can be used for most non-power and ground lines on the ICs and on many connectors to ensure proper connection and/or connector presense.

Capacitor Polarity

In some cases, constant-current and voltage measurements of a polarized capacitor can be used to detect incorrect polarity since the capacitor draws additional current as the voltage increases in the incorrect polarity. As a practical matter, this technique cannot be used in many cases during in-circuit testing because of voltage or parallel impedance limitations. In this case, TestJet Technology can be used to detect the polarity of most axial/SMT aluminum and tantalum capacitors up to about 200µF.

Quick-Test

To test UUTs without programming, CheckSum offers the `Autoprogram' algorithm. This allows you to place a known-good UUT on the test fixture for the System to self-program itself. Other boards can then be tested to find differences that may be indicative of faults. Detected properties include open/shorts, resistance, capacitance and diode junction presence. While this algorithm does not provide the detailed diagnostic messages of a fully-programmed UUT, it can help get boards up on the System quickly for use while programming, or as a complete test on prototype or short runs.

Power Supply Capability

The ***Analyst ems*** system can include a power module that can be used to provide higher current outputs from the system. These higher current outputs can be used to actuate UUT relays, power-up low power UUTs, provide additional guard current, or apply stimulus for power-up testing. The module has dual voltage-programmable high current outputs that can be set from +12V to -12V (up to 24V differential). For switching these outputs to the UUT, 16 relay test point outputs are provided. Voltage and current output can be monitored. Fixed switched supplies provide +12V, +5V and -12V at the fixture interface. These outputs can be switched on or off via on-board relays and are fused for protection of the system and UUT. Eight additional digital pins can be used for digital input/output or to energize external relays.

The system can include the optional **PS-UUT-L1** programmable power supply, 0 to 60 VDC, up to 12.5A.

Optional Power Supply

PS-UUT-2 power supply option includes:
2 programmable supplies, 0 to 60 VDC, up to 12.5A

Optional Digital Test Capability

Digital I/O

The ***Analyst ems*** can be configured with an optional 48 or 96 digital I/O pins. These pins can be relay-connected to the UUT in byte increments. Within each byte, each pin can be set to be an input (tri-state output) or an output. Since each pin has a 10KΩ pull-up (in conjunction with totem-pole outputs), it is compatible with most logic families. VCC for output can be selected to be +5V or +3.3V.

Boundary-Scan

The ***Analyst ems*** software works with leading boundary scan tool prodviders like *Asset-Intertech, Corelis, Goepel and JTAG Technologies.* In addition, boundary scan can be used by some programmable devices to perform in-system programming and program verification.

MultiWriter On-Board Part Programming System

MultiWriter is the first ICT-based in-system programming technology designed from the ground up specifically for popular serial-bus programming protocols. MultiWriter solves the productivity bottleneck created by today's multi-panel boards and large, data-hungry ISP chips. MultiWriter can simultaneously program up to 384 ISP chips at near data-book speeds.

Other System I/O

In addition to the power/stimulus/measurement capabilities already mentioned, the System has a number of other functions available. These include:

8	Bits of Digital I/O / Relay drivers (PWR-2)
2	Switched grounds (PWR-2)

System Switching Topology

The ***Analyst ems*** offers a flexible switching topology to minimize custom circuitry and to allow assemblies to be easily programmed.

The system uses a N (up to 5200 for the 12KN) x 16 solid-state analog bus that allows each test point to be connected to one of 16 places. Each point can be a measure source high, measure source low, measure sense high, measure sense low, guard source, guard sense, or DC/AC signal source. The solid-state matrix provides high-speed and reliability for power-down testing, or for functional testing of points that do not exceed ±12V referenced to the controller chassis.

A relay bus matrix (2 x M) can be used for signals in excess of 10mA, or for voltages greater than ±12Vdc (i.e., Zener measurements).

Digital test points are available at the fixture interface blocks. They can be relay-disconnected during power-down test, then enabled (by byte) during power-up test.

Power outputs are available at the fixture interface blocks. They can be relay disconnected during power-down test. This includes the ground signals so that the UUT is fully floating.

System Software

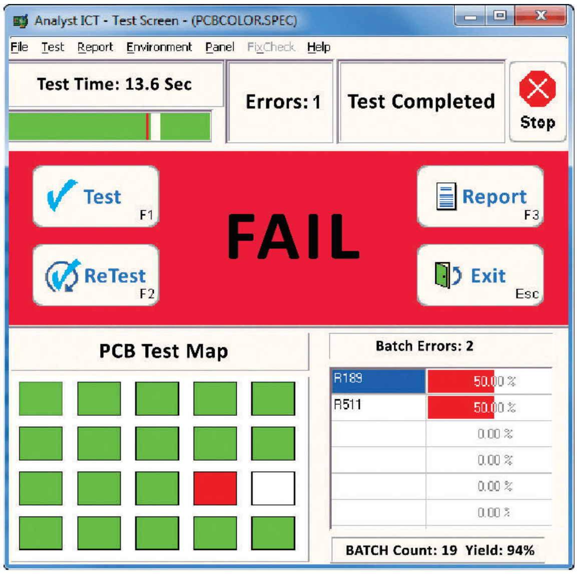
The system comes complete with a comprehensive, yet easy-to-use software package. Running in the Windows OS environment, users find it to be intuitive and efficient. It is network-compatible and includes comprehensive on-line help. There are several major blocks in the software package:

Testing Environment

The system can be setup to accommodate a variety of philosophies about how to present data to the operator.

In the most simple case, the operator places the UUT into the fixture, then uses the Start and Safety switches on the front panel to start the test. The fixture actuates, and the test begins. Once the test is completed, the screen shows a large red FAIL or green PASS indication, and the fixture is de-actuated. Testing status is shown on the CRT, along with red (fail), green (pass) and amber (busy) lights on the stack-light and front panel.

The operator can then choose to ReTest, or move to the next UUT. Most users configure the system to automatically print out a test report of component failures on the system printer if the UUT fails. The operator then attaches the failure report to the bad UUT, and sends it off for repair. The next UUT is then put into the fixture and the



process starts over again. This simple operation cycle is easy to use by unskilled operators. Paperless repair is also possible including built-in serial number tracking.
The system can be set up to halt on each failure if you would like your operators to be able to repeat steps, or repair the UUT as faults occur.

You can also view a real-time Pareto report of failures during each batch of UUTs. By observing this sorted table of specific failures, you can quickly detect repetitive process faults.

Test reports can be automatically generated in a variety of configurations, or can be manually selected by the operator.

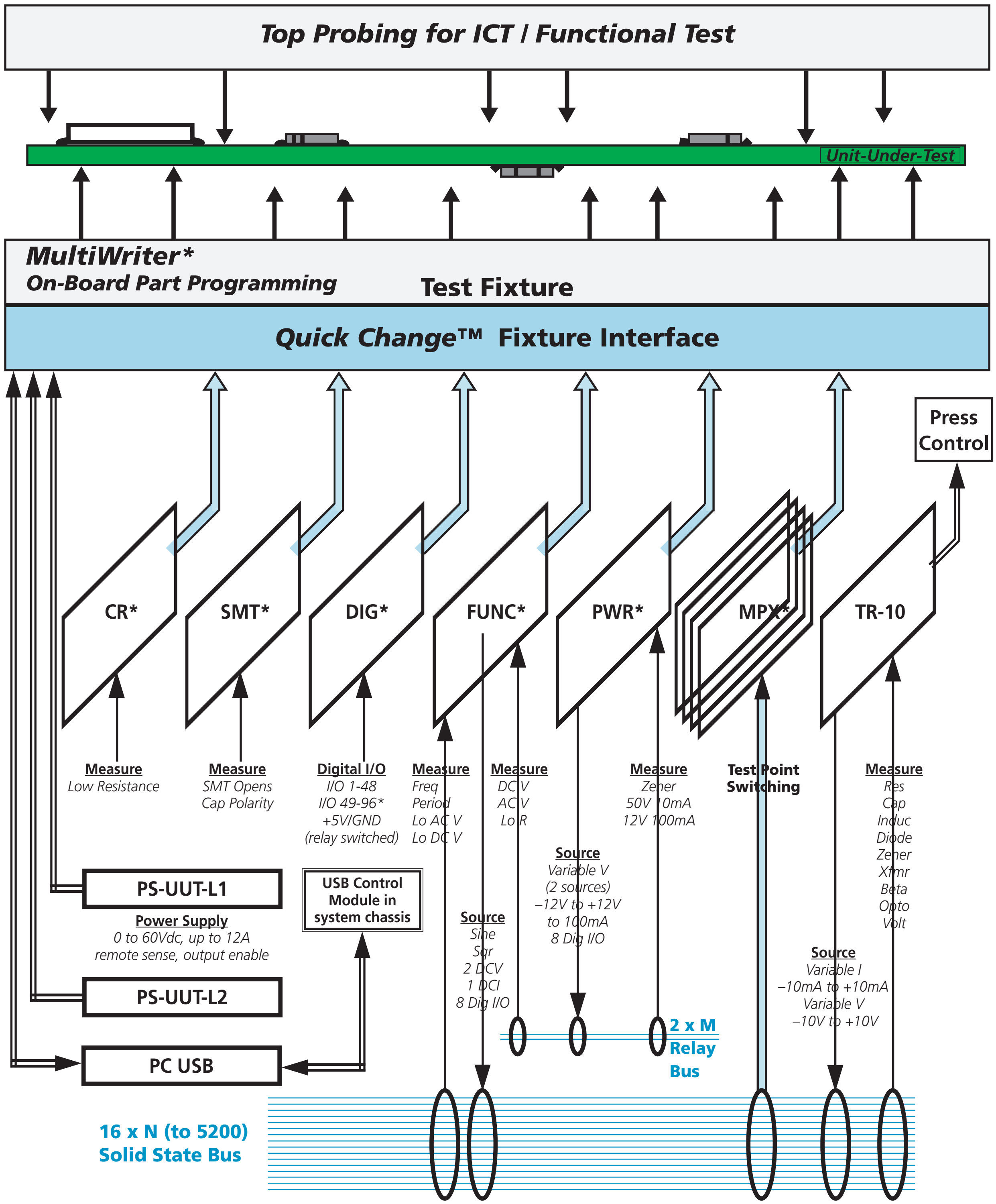
Panelized UUTs are accommodated during testing operations. As the test is performed; you can observe a graphical status representation of the panel as each UUT in the panel is tested. At the end of the test, each UUT in the panel is shown as a pass/fail/skip, and result reports are separated by UUT.

While there is a wide variety of capabilities for the operator, you can use the system's login capability to tailor the resources available to each user. Not only does this provide ease of use based on operator skill level; it can provide integrity to test programs and the system configuration so they cannot be modified by unauthorized personnel.

The system can log serial numbers of assemblies, either through manual entry, or via an optional bar-code reader.

Statistical Process Control

The system can be set up so that it logs statistical data. When this is enabled; you can obtain several types of



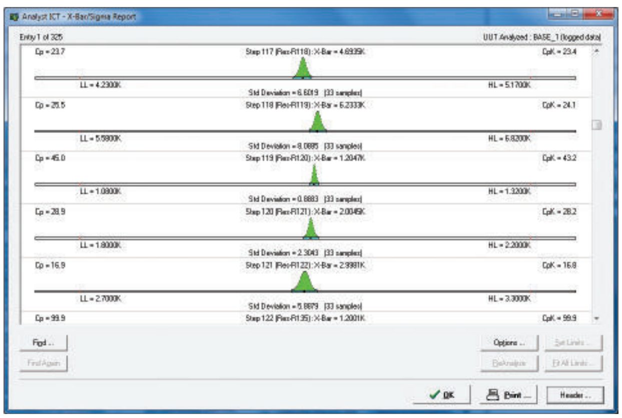
* optional equipment shown in a typical test system

reports. Reports can be limited by beginning date and time and ending date and time. You can also report on all UUTs, or choose particular ones to analyze.

The **Production** report lists which UUTs have been tested, the failure rate and how many defects have occurred. This is valuable to determine overall production, production by shift, production by UUT, and production failure rates.

The **Pareto** report lists the faults sorted by occurrence. For example, you might find that your greatest source of error on one assembly is R101. You might find that frequently the roll of parts used to feed R101 is incorrect, or perhaps the part is difficult to install, or a particular shift is having more trouble than others.

The **X-Bar/Sigma** reports are used to show, by individual analog measurement, the mean (average), standard deviation, 3-sigma limits, Cp and Cpk. This data is graphically displayed with a predicted distribution curve and high/low test limits.



While this information can be used to monitor process measurements, it is more often used to help fine-tune test program tolerances. By observing the data, even with a relatively small programming sample size, it is practical to set control limits that are applicable to a wider range of UUTs.

Raw statistics data is logged on the disk in ASCII format, comma-delimited, so that you can write your own custom analysis software if desired.

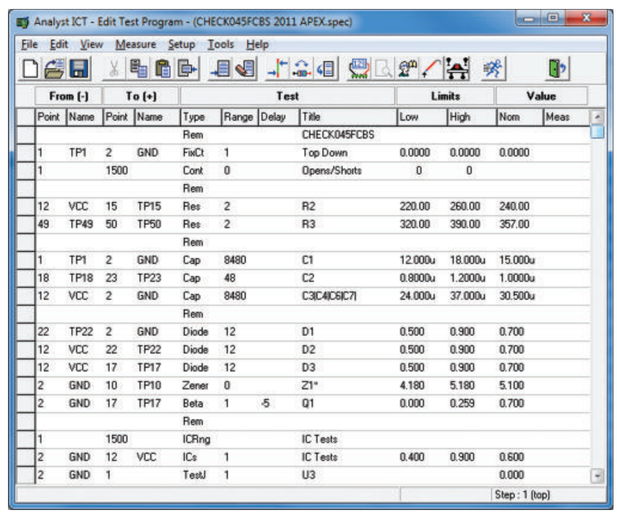
Test Program Generation

The system includes all the software necessary to write and modify your test programs. Many users have CheckSum build test fixtures and write test programs; however, many users do these functions in-house or use local contractors to help in this effort.

Test programs are generated in an interactive spreadsheet-like environment, with each line specifying one test step. Typical test steps include RES (resistance test), CAP (capacitance test), CONT(inuity test), JMPx (jump based on some conditional), MEMx (memory math), RELAY (specify relay closure), DIGO (digital output). The line contains other information relevant to the step. For example, a RESistance test step would include two test point names and numbers, a measurement range, nominal (expected) value, and high and low test limits.

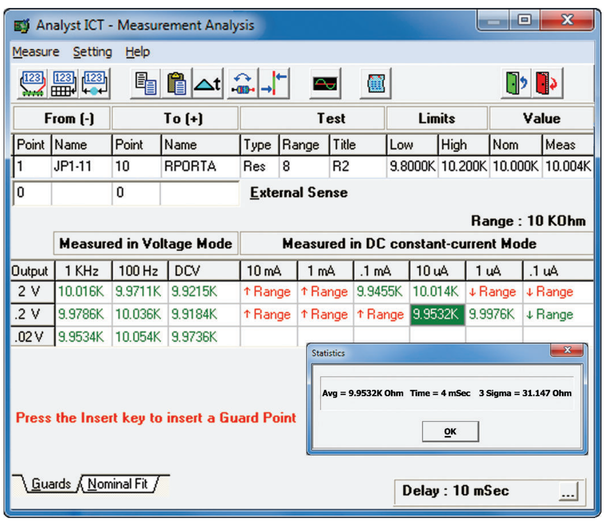
The test programming language is rich in features. In addition to normal measurement and stimulus test types, features include mathematics functions, file I/O, jump based on measurements, math, or operator input, display of messages, operator input, interactive adjustment routines, calling of external programs that you have written, and a host of other capabilities to make programming easy and flexible.

Each test program can have up to 30,000 test steps, and test programs can be transparently linked together to provide unlimited length programs, or to allow you to make libraries of program segments that you can reuse.



If you have CAD data for your assemblies, it can be used to generate the preliminary test program and a wiring report. The system accepts ASCII net list and component information from many popular CAD formats including OrCAD, P-Cad, Mentor, HP-BCF, Cadence, Racal-Redac, Viewlogic, Tango, ComputerVision, Pads2000, Scicards, Fabmaster and Accel. Even if you are using another CAD package, it may be able to generate output for one of the supported formats. The automatically generated program contains test steps for the components in the net list, and a wiring report. Once the fixture is built and wired, you can load the generated program, then fine-tune test steps as necessary. Typically, about 70% of the generated steps initially pass. Once the program is interactively optimized with appropriate ranges, polarities and guard points, you can self-learn CONTinuity and ICs data, and the power-down test is ready to use. Functional programming is hand-entered to meet the specific needs of the UUT.

Entry or generation of programs can be done off-line in your office. Optimizing the program is done on the test station and involves choosing the best methods of making measurements. While in the test program editor, you can execute tests. If you are not satisfied with the result, you can enter a menu that displays the measurement taken with a variety of techniques and ranges. You can quickly choose the best technique/range, add guard points, change polarity or add delays to obtain the best test results. Other tools include X-Bar/Sigma, measurement time, and time/voltage displays for each basic measurement type.



Panelization facilities include a step-and-repeat mode. This allows you to specify the panelized format and the initial wiring points for each PCB in the panel. Once you have written and debugged the first UUT in the panel, the system will then automatically generate the steps for the other PCBs. At run-time, the operator can elect to skip PCBs in the panel that are not populated or known-defective.

ActiveX Automation Server

If your software development tool can access ActiveX Automation Server, you can automate a subset of Visual software test functions from your application. For example: starting Visual software, opening a test program, executing the test program, printing the test result report to a file. Using a Visual Basic Script is one example of automating Visual software using the COM interface. Visual Basic Script is a simple scripting language and readily runs in the Microsoft Windows Operating System.

Station Configuration

The station configuration software is used to set up the station's software and hardware environment.

To manage the system hardware, the station configuration software provides for specification of the hardware configuration in the system and includes a comprehensive self-test facility for each module. The self-test software checks each module for proper operation. In many cases, the system also performs self-calibration of modules against internal standards. This data is then saved to the system disk for future use. If external traceability is necessary in your installation, the system can be checked against an external calibration module (included), and optional functional test electronics can be calibrated against typical external standards using included interactive software.

The login capability can be enabled to allow users to login to the system. This can be used so that reports and internal SPC logs contain the operator name. Optionally, passwords can be assigned for each user. Each user can be assigned privileges, to the level of each individual menu selection in the system.

Reporting capabilities can be configured to meet a wide variety of needs. Test reports can be output on demand, always, or on failure only. The reports can contain all results, or just results for failed steps. The header format, and amount and order of information for each step can be specified, as well as the destination device (e.g., which printer, or to the system display). Test program reports can also be configured to include or exclude specific data. SPC data-logging can be disabled, or enabled for pass-only steps, pass and fail steps, or just test summary information.

Configuration

The ***Analyst ems*** consists of a complete, ready to use system and typically includes:

System Electronics with *Analyst ems* software
200 Test Point MPX Modules
TestJet Technology Module and License
Power Module
Power Supply
Fixture System
Calibration/Verification Fixture
PC, Industrial Chassis, USB system module
Printer, 40-column, dot-matrix

Options/Accessories

The system can be configured with additional test point modules and other options that can expand the system to 5200 test connections.

PS-UUT-L2 Two Programmable Power Supplies
MPX-3-200 200 Test Point Module
FUNC-2 Functional Test Electronic Module
DIG-1 48 Point Digital I/O Module
CR-2 24 Point Milli-Ohm Meter Module
SMT-2-EXP TestJet Technology 24 Channel Expansion Module
Blank Filler for rack (1U, 2U, or 3U)
Ribbons and paper for the T-120-2P Printer

System Specifications

Resistance Measurement

Resistors are measured with a choice of DC-constant-current, DC-constant-voltage, or AC-complex-impedance measurements. Low impedance measurements can be externally sensed.

Measurement using DC Current Stimulus

Range F.S.	Current	Voltage at F.S.	Accuracy
19Ω	10mA	0.2 V	2% F.S.
190Ω *	10mA	2 V	1% F.S.
1.9KΩ *	1mA	2 V	1% F.S.
19KΩ *	0.1mA	2 V	1% F.S.
190KΩ *	10µA	2 V	1% F.S.
1.9MΩ *	1µA	2 V	2% F.S.
19MΩ	0.1µA	2 V	5% F.S.

*0.2V ranges are available. For 0.2V ranges, multiply typical accuracy by 3. For internally sensed measurements, add 2Ω to accuracy. Maximum voltage may exceed full-scale value during over-range.

Measurement using AC/DC Voltage Stimulus

Range	Source Voltage, Typical	Accuracy
0Ω to 10KΩ	3.8V DC or 2VAC RMS	1% Value+0.5Ω
10KΩ to 100KΩ	3.8V DC or 2VAC RMS	2% Value
100KΩ to 1MΩ	3.8V DC or 2VAC RMS	4% Value
1MΩ to 10MΩ	3.8V DC or 2VAC RMS	10% Value (20% @ 1KHz)

0.2V & .02V sources are also available. For 0.2V, multiply accuracy by 3. For .02V, multiply accuracy by 10 (not specified above 1MΩ). For internally sensed measurements, add 2Ω to accuracy. Available AC stimulus frequencies 100Hz and 1KHz. Technique is fully auto-ranging. Source current is less than 10mA.

Inductance Measurement

Inductors are measured with AC-complex-impedance measurements. Effective measurement range is 1µH - 1000H.

Range	Accuracy			
	100KHz	10KHz	1KHz	100Hz
1µH - 10µH	4%+0.5µH	4%+0.5µH	10%+2µH	–
10µH - 100µH	4%+2µH	4%+2µH	10%+4µH	–
100µH - 1mH	4%	4%	4%	10%
1mH - 10mH	10%	4%	4%	4%
10mH - 100mH	–	10%	4%	4%
100mH - 1H	–	–	10%	4%
1H - 10H	–	–	–	10%
10H - 100H	–	–	–	10%
100H - 1000H	–	–	–	20%

Specifications assume residual inductance is offset. Specifications apply to 2V source. 0.2 and 0.02V sources are also available. For 0.2V, multiply accuracy by 3. For 0.02V, multiply accuracy by 10. Technique is fully auto-ranging. Source current is less than 10mA. Measurements less than 100µH should be externally sensed for full accuracy.

Capacitance Measurement

Capacitors are measured with a choice of DC-constant-current or AC-complex-impedance measurements. Measurements can be effectively made from 2pF - 20,000µF [3].

Range	Accuracy					
	100KHz	10KHz	1KHz	100Hz	1mA	10mA
1pF - 100pF	4%[1]	4%[1]	4%[1]	–	–	–
100pF - 1000pF	4%[2]	4%[2]	4%[2]	10%[2]	–	–
1000pF - 0.01µF	10%	4%	4%	4%	–	–
0.01µF - 0.1µF	–	4%	4%	4%	–	–
0.1µF - 1µF	–	10%	4%	4%	–	–
1µF - 10µF	–	–	4%	4%	–	–
10µF - 100µF	–	–	10%	4%	4%	–
100µF - 1000µF	–	–	–	10%	10%	4%
1000µF - 20000µF	–	–	–	10%	20%	10%

Notes:

1. ± 5pF
2. ± 10pF
3. While small isolated capacitances (pF region) can effectively be tested by the system, often times in-circuit influences such as parallel impedances in IC's degrade measurements. Values less than 100pF can be difficult to measure in many circuits.

Specifications assume residual capacitance is offset and apply to 2V source. 0.2V and 0.02V sources are also available. For 0.2V, multiply accuracy by 3. For 0.02V, multiply accuracy by 10. Technique is fully auto-ranging. Source current is less than10mA.

Guarding Capability

The test system provides guarding to minimize the effects of parallel impedances. Without special wiring, any test point can be used as a measurement point, a guard point, or an external sense point. All points can be guarded (with selected deletions), or up to six individual guard-points can be simultaneously used. Each measurement or guard point can be externally sensed.

Guarding uses a separate guard amplifier for each guard point to provide extremely precise guarding. Even without guarding, the system can often directly measure components of different types connected in parallel, such as a capacitor and a resistor, using complex-impedance measurements.

When guarding currents in excess of 15mA are required, the PWR-2 is used as the source and the test points must be wired to the PWR-2 sixteen (16) relay test points.

Guarding

Maximum Current per Test Point	10mA
Max. Number of Simultaneous Guard Points	6 (or guard-all less selected points)
Maximum Total Guard Current (TR-10)	20mA
Maximum Total Guard Current (PWR-2)	120mA

Typical Resistance Measurement Accuracy Degradation when using Guarding:

Guard Ratio	Multiply Accuracy
1:1	x 1
10:1	x 2
100:1	x 3

Any test point can be designated as a guard or external guard sense point without special wiring, except Power points.

Voltage Measurement

Diode and Zener Diode Measurement

Standard diodes, LEDs and zener diodes are tested by applying a constant current to the anode and cathode, then measuring the resultant voltage (forward voltage drop). Measurements of up to 50V can be performed using up to 100 mA of applied current.

Diode Test Type

Accuracy

	Source Current		
Range	10mA	1mA	0.1mA
2V	±40mV	±40mV	±40mV
10V *	±200mV	±200mV	±200mV

* Typical constant current to 7V compliance

Zener Test Type

Range	Source Current	Accuracy
12V	100mA *	±300mV
20V	10mA	±300mV
50V*	10mA	±1.1V

* 100mA and 50V requires wiring to PWR-2 (16) relay test points.

DC Voltage Measurement

DC Voltage Measurement (VOLT test type)

Measurement Range	Accuracy
± 0.2V	4mV
± 2.0V	40mV
± 10 V	200mV

Ranges are bipolar. Stimulus may float ±8V from controller chassis ground.

Opens/Shorts Measurement

The system self-learns a known-good UUT, then tests against this map. The continuity map can be edited and no-care conditions can be specified for measurements where components exist, and either condition is acceptable.

Connection/Open Thresholds	Separately programmable from 2Ω - 50KΩ
Typical Test Time for 1000 Test Points	1-2 seconds

(Test time depends on UUT circuit topology)

Low Threshold Continuity (rated speed)

Range	Threshold
1mA	2Ω to 50Ω

High Threshold Continuity (lower speed)

Range	Threshold
100µA	20Ω to 500Ω
10µA	200Ω to 5KΩ
1µA	2KΩ to 50KΩ

IC-Orientation/Presence Measurement

IC presence and orientation is verified by checking the semiconductor junctions of the protection diodes typically present between IC pins and the UUT power supplies. Using a proprietary algorithm, the system self-learns a mapping of these ICs and tests against this map. The map can be manually edited for specification of specific tests and no-cares.

Constant Current Ranges	Threshold
0.1mA/1mA	0 to 2V
1mA/10mA	0 to 2V

Opto-isolator Testing

Diode Drive	Measurement Stimulus	Measurement Threshold
0mA to 10mA	1mA	0 to 2V

Transistor Testing

Three terminal devices can be measured between the power terminals (e.g., collector and emitter) while biasing the control terminal with another test point using voltage or current. This can effectively measure the operation, and in most cases the polarity of devices such as FETs, SCRs and transistors.

Third Terminal Drive	Measurement Stimulus	Measurement Threshold
0mA to +1mA	1mA	0 to +2V
–10V to +10V	1mA	0 to +2V
0mA to –1mA	–1mA	0 to –2V
+10V to –10V	–1mA	0 to –2V

Voltage Sourcing

Low Power Sourcing

DCV 5

Amplitude	–10V to +10V in 80mV steps
Accuracy	3% ±80mV
Test Point Source Resistance	< 1KΩ

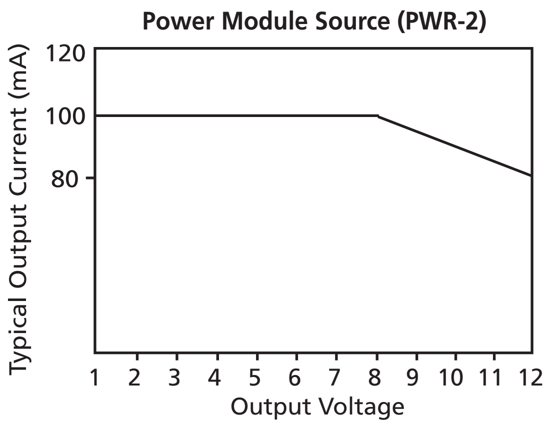
Sourced from TR-10

Power Source

DCV 3 and DCV 4

Amplitude	–12V to +12V in 6mV steps
Accuracy	3% ±6mV when not in current limit
Test Point Source Resistance	< 4Ω

Sourced from PWR-2



Current Measure Accuracy	10% ±5mA
Voltage Measurement Accuracy	10% ±0.3V when in current limit
Available Signals	16 relay test points

Constant Current Sourcing

Low Power Sourcing

Range	Resolution	Accuracy
–1mA to 1mA	4µA	3% ±4µA
–10mA to 10mA	40µA	3% ±40µA

Sourced from TR-10

High Power Sourcing

Fixed Current	100mA ±5%
Compliance Voltage	> 8V

Sourced from PWR-2

Optional Digital I/O

Available are 96 dedicated test points (each DIG-1 module provides 48 points). These test points are relay isolated when not in use. They can be wired in parallel with the general purpose test points.

Number of Bits	48 individual input or output
Logic Level	Selectable 3.3V or 5V, TTL/CMOS compatible
Output Sink	10mA at 3.3V, 24mA at 5V
Output Source	3mA
Input Load	10KΩ pull-up to 3.3V or 5V

Sourced from DIG-1

High Current Digital I/O

Provides digital capabilities that allow you to perform low-speed digital input and output for test of UUT functionality. The digital I/O capability can also be used to drive relays or send and receive digital signals and switch closures controlling test flow.

Open-collector outputs can directly control external relays requiring up to 100mA when used with an external source. The digital outputs can be left floating, or jumper-connected through pull-ups to either +5V or +12V. The status of the eight bits can be read back by the system.

Number of Bits	8 on PWR-2
Direction	Output with readback
Logic Family	5V TTL/LS/CMOS
Outputs	Open-collector with pull-up
Distribution	Back panel connector and fixture interface
Sink/Source	Sink 100mA. Source determined by pull-up resistor.
Pull-ups	10KΩ socketed pull-up to +5V or +12V

Sourced from PWR-2

Optional Power Supplies

Dedicated Power Outputs

PS-UUT-L1	Programmable 0 to 60Vdc, up to 12A, remote sense, output enable control
Vout:	4 digits, accuracy: 0.5% of rated voltage + 1 count
Iout:	4 digits, accuracy: 0.5% of rated current + 1 count
PWR-2	12V @ 1A, 5V @ 1A, –12V @ 0.1A fused and switched
DIG-1 (optional)	5V @ 1A fused and switched

Undedicated Relays

PWR-2	4 SPDT, 1A relays, less than 2Ω lead resistance

TestJet Technology

The system can discriminate up to three pins on the same network on the same IC. Each SMT-2 module can make measurements of up to 24 normal or capacitor probes. With SMT-2-EXP optional modules, up to 384 components can be tested. Each module contains a switched signal ground and a relay driver output for low impedance grounding in the fixture. Relay drive is 100mA at 12V.

Measurement Range	Resolution
0fF to 300fF	2fF
20fF to 3000fF	20fF

Capacitance Polarity

The SMT-2 module can also be used to measure polarity of capacitors. The SMT-2 makes use of special top-sensing probes and can be used for aluminum and tantalum polarized capacitors in axial and SMT packages, up to approximately 200µF. Radial aluminum electrolytic capacitors generally cannot be tested using this technology. Up to 24 top probes can be connected to each module. With SMT-2-EXP optional modules, up to 384 components can be tested. Each module contains a relay driver for low impedance grounding in the fixture.

Operating Environment

The test system operating temperature range is 0°C to +35°C with 0 to 80% RH (without condensation). Rated accuracy at ±10°C from calibration temperature. Maximum altitude for operation is 3000m (9843 ft.).

Calibration and General Notes

The system calibration cycle is 6 months. To obtain stated accuracies, low impedance measurements (less than about 100Ω) may require external sensing to compensate for typical 5Ω to 10Ω lead resistance beyond internal sense points. Self-test performs automatic offset characterization for this lead resistance.

All specifications shown are typical accuracies when measuring isolated components. Accuracies may degrade depending on surrounding circuitry. Specifications are typical for a system with externally sensed measurements when impedances are less than 100Ω.

There are some limitations on the number of simultaneous sources available. Unless otherwise stated, all measurements and stimulus are from the TR-10 system electronics.

CheckSum test systems utilize sophisticated capabilities such as guarding, complex-impedance measurement, vectorless test with TestJet Technology, in-system programming with the CheckSum MultiWriter on-board part programming system, and fully integrated functional test.

By providing reliable, high-performance, easy-to-use, PC-based in-circuit test (ICT) systems with excellent support and documentation, CheckSum is able to sell its products at a fraction of the cost of comparable test systems from traditional ATE companies.

Our installed base of over 3000 systems worldwide is a proven solution for customers ranging from consumer, automotive, and industrial OEMs to global contract manufacturers. In addition, CheckSum is the only U.S. ATE vendor supplying complete turnkey bed-of-nails test fixtures, program and support.

CheckSum designs, develops and manufactures the critical components of its test systems. Test systems include the measurement electronics, software and fixturing components that provide a complete system solution. In addition, CheckSum can provide custom fixturing and programming for your assemblies.

This fundamental product and engineering-oriented approach to design, sales and support has allowed CheckSum sales to grow significantly each year, from its start in 1987 to a multi-million dollar corporation today.

In the U.S., CheckSum sells directly from our headquarters in Arlington, Washington. If a CheckSum Test System doesn't work to your complete satisfaction, it can be returned within 30 days for a prompt refund or cancellation of the invoice.

Visit our web site at ***www.checksum.com*** for up-to-date, on-line information.

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Specifications subject to change (20140822)