Analyst ems V12 System

In-Circuit and Functional Test System

The CheckSum ***Analyst****emsV12* is designed for testing most common circuit assemblies. It combines in-circuit test (ICT) with power-up functional test capabilities to provide extremely high fault coverage in a single, low-cost test station.

ICT tests the unit under test (UUT) without power applied. Using sophisticated measurement techniques such as DC and complex-impedance measurements and multi-point guarding it 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 UUT is in the safe unpowered mode, and with very specific fault diagnostic messages, faulty UUTs can be repaired quickly.

Once the ICT/MDA tests have successfully completed, the ***Analyst****emsV12* provides the capability to power up the UUT to test for performance faults. This capability can be used to help ensure that the UUT will operate properly in its end environment, finding problems such as faulty ICs or other subtle performance problems.

The ***Analyst****emsV12* is designed to be used for most common circuit assemblies. It can perform effective power-down testing for most analog or digital assemblies being manufactured today. The power-up functional testing is ideally suited for lower frequency analog-type assemblies with some digital content.

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-Off Test Capabilities

For analog in-circuit testing (ICT), 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 in-circuit tests run at a rate greater than 1000 tests per second.

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 (.05V to 2V full range), or AC complex-impedance measurements using 100Hz or 1KHz stimulus. 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 0.05V to 2V. Inductance 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.

Voltage Measurements
For UUTs that have batteries, the DC voltage can be measured. The DMM test 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.

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.

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
Coil voltages up to 24V with up to 100mA of current 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 (typically 1mA or 10mA), 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
Zener diodes are tested by testing as a conventional diode and then providing a constant current source (typically 1mA to 100mA), to measure the reverse breakdown voltage. 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.

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
Integrated circuits (ICs) can be tested by using the ICs test. This test measures each IC pin to VSS and VDD, checking for the presence of the IC's internal protection diodes. This test detects most faults such as shorted pins, open pins or misoriented 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
If the System is configured with the optional SMT-2 module, it can detect opens to IC pins, even though the pin is bussed to other ICs. This advanced technology (licensed to CheckSum by Keysight Technologies), 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 is significantly less. This technology can be used for most non-power and ground lines on the ICs.

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, the SMT-2 option can be used to detect the polarity of most axial/SMT aluminum and tantalum capacitors up to about 200µF.

Power-On Functional Test Capabilities

Once power-off testing is completed, the ***Analyst***$_{emsV12}$ can power up the UUT to test for proper performance. This can be done on the same fixture as the ICT/MDA test so that minimal time is spent transferring, loading and unloading your UUT.

Since the ***Analyst***$_{emsV12}$ has a combined solid-state and relay switch matrix, most power-up testing is done with relays that provide high current ratings and higher voltage-standoff for the UUT. UUTs with voltages up to about ±12V are accommodated with the solid-state multiplexing, and voltages up to 250Vp-p are accommodated when using the System's relay switching.

When greater than 40 volts is present at the UUT during test, the test fixture should be designed with safety shielding to help prevent the operator from coming in contact with the signals.

The System can be placed in 19 inch rack space, and off-the-shelf measurement/stimulus instruments or programmable power supplies can be configured to meet your special requirements.

Power Supply Capability

The ***Analyst***$_{emsV12}$ system can be configured with optional power supplies used to power-up your UUT.

Optional Power Supplies

PS-UUT-Lx power supply option includes:
up to four programmable supplies, 0 to 60 VDC, up to 12.5A. These supplies include remote sensing and current limit/readback capabilities.

The optional PWR-2A module provides switched +5VDC @ 1A, +12VDC @ 1A, and -12VDC @ 0.1A are available at the fixture interface panel.

Variable Supplies

Variable DC supplies include ±10VDC (600Ω source impedance), ±12VDC (100mA source current), and –10mA to +10mA constant current.

Measurement Capability

DC Volts

The system can measure up to 250VDC in a fully differential input mode. Ranges include 0.2V, 0.6V, 2V, 6V, 10V, 20V, 60V, 200V and 600V (rated to 250V) and auto-range.

AC Volts

The system can measure up to 250V*RMS*. The true RMS measurements are provided with AC or AC+DC coupling. Ranges include 0.2V, 0.6V, 2V, 6V, 20V, 60V, 200V, 600V (rated to 250V) and auto-range.

Frequency

Frequency measurements can be made from DC to 10MHz. Higher frequencies can be performed if the test fixture includes a pre-scaler. The UUT ground-referenced input can be from 300mV to 5V, and can be AC or DC coupled. The trigger level can be set in the range of ±2.2V.

Period

Period measurements can be made from 12.8 milliseconds to 128 seconds. The UUT ground-referenced input can be from 300mV to 5V, and can be AC or DC coupled. The trigger level can be set in the range of ±2.2V, and can be set to respond to rising or falling transitions. Period measurements can be made with A and/or B inputs.

Counts

Counts can be made of up to 65,535 events based on the trigger event occurring. The UUT ground-referenced trigger input can be from 300mV to 5V, and can be AC or DC coupled. The trigger level can be set in the range of ±2.2V, and can be set to respond to rising or falling transitions. Up to 5MHz signals can be counted.

Stimulus Capability

DC Volts

The System has three DC voltage signal sources, each of which can source up from ±10V, and providing up to 10mA of current. These sources are internally sensed.

Sine Wave

The System can provide sine wave output in the range of 100mV to 20Vp-p (7V*RMS*). The frequency selection range is 1Hz to 100KHz. Sine wave output is UUT ground-referenced and can provide up to 10mA of output.

Square Wave

The System can provide square wave output. The amplitude can be up to ±10V with reference to UUT ground, or can be between two programmable amplitudes each from ±10V, with up to 10mA. The frequency selection range is 1Hz to 100KHz.

DC Current

The System provides two 100mA current sources with programmable voltage. Each source can be programmed to a compliance voltage between ±12V. When used together, the sources can provide up to 24V differentially.

Digital I/O

The standard configuration of the ***Analyst***$_{emsV12}$ includes 8 digital I/O pins. These pins are LVTTL logic levels.

The DIG-1 option provides up to 96 additional 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***$_{emsV12}$ can be configured with an optional Boundary-Scan test capability from most major boundary scan tool providers (Asset-Intertech, Corelis, Goepel, etc.) This allows the System to be used with UUTs that have been designed to accommodate boundary-scan, or have on-board devices that support boundary-scan. In addition, boundary scan can be used by some programmable devices to perform in-system programming and program verification.

MultiWriter ISP System

MultiWriter is the first ICT-based ISP system 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 options include:

8	1A Form-C Relay contacts (FUNC-2/PWR-2)
2	+5VDC 1A fused outputs (FUNC-2/PWR-2)
2	+12VDC 1A fused outputs (FUNC-2/PWR-2)
2	–12VDC 0.1A fused outputs (FUNC-2/PWR-2)
16	Bits of Digital I/O / Relay drivers (FUNC-2/PWR-2)
1	Switched ground (PWR-2)

System Switching Topology

The ***Analyst***$_{emsV12}$ offers a flexible switching topology to minimize custom circuitry and to allow assemblies to be easily programmed.

The system uses a n 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.

Additional solid-state switching points can be added in 200 point increments for ICT.

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

There are two special 2x16 relay busses available. One is connected to the 100mA current sources and the other to the DMM high-voltage inputs. These can be handy, for example, when selectively applying voltage to multi-UUT panels assemblies.

System Software

The system comes complete with a comprehensive, yet easy-to-use software package. Running in the Windows 32 or 64-bit environments, users find it to be intuitive and efficient. It is network-compatible and includes comprehensive on-line help. The software also includes a Microsoft COM API for integration with other software platforms.

Testing Environment

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

In the most simple case, the operator places the UUT into the fixture. They may optionally enter a barcode serial number and/or batch ID. They then activate the test system using 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 monitor, along with red (fail), green (pass) and amber (busy) lights on the 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.

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 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. This data can be sent to any location within the customer's network. The data is provided in an ASCII, comma-delimited format for easy importation into other data collection systems.

The system includes three basic reports at no extra charge. The Production report lists which UUTs have been tested, the failure rate and how many defects have occurred. The Pareto report lists the faults sorted by occurrence. And finally the 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.

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.

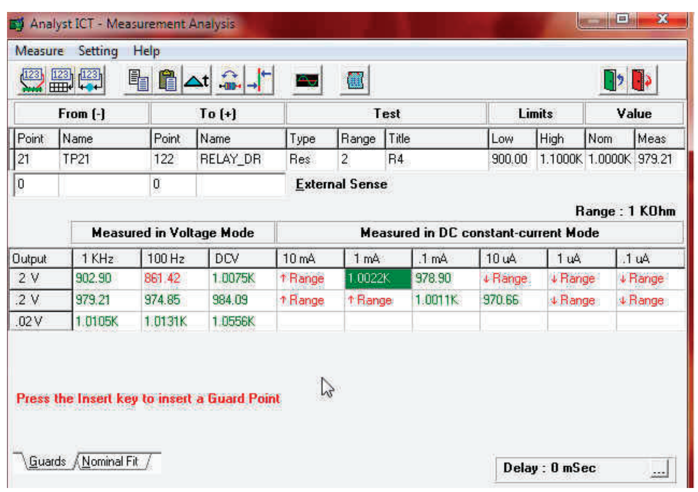
Test programs are generated in an interactive spreadsheet-like environment, with each line specifying one test step. Typical test steps include RES (resistance test), CAP (capacitance test), IND(Inductor test), BETA(Transistor test), DIODE(Diode test), CONT(inuity test), RELAY (specify relay closure), SINEV (source sine wave), 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 be up to 30,000 steps, and test programs can be transparently linked together to provide unlimited length (for all practical purposes) 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 ICT test program and a wiring report. The system accepts ASCII net list and component information from many popular CAD formats. An optional fixture design software package allows you to design your test fixture and create the CNC files needed to fabricate the fixture. 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.



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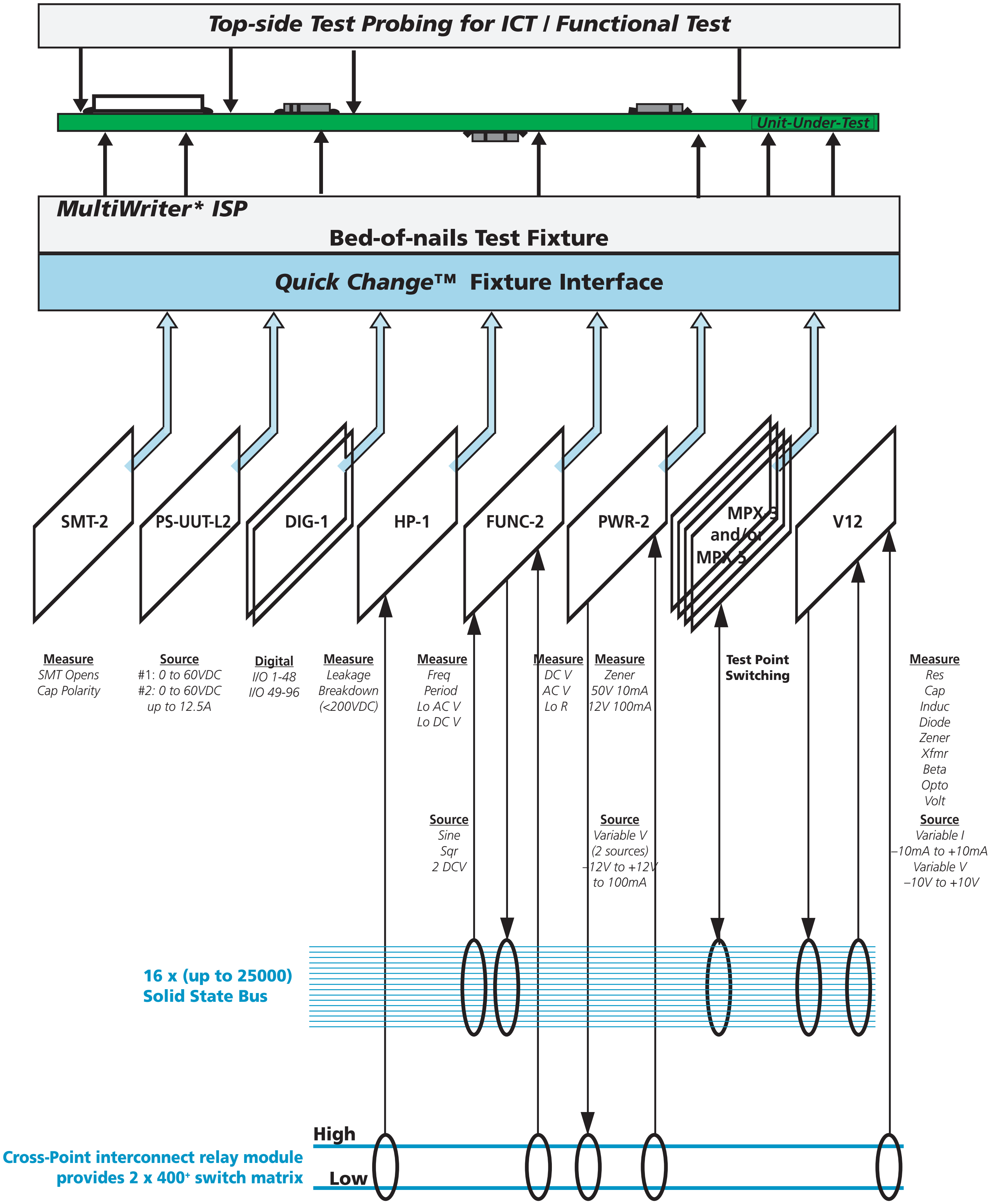

* Options MPX-3, MPX-5, PWR-2, FUNC-2, HP-1, DIG-1, PS-UUT-L2, SMT-2

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 the 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 monitor). 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.

Accessories & Options

The system can be configured with additional test point modules and other options that can expand the system to over 10,000 test connections.

CR-2 24 Point Milli-Ohm Meter Module
HP-1 High Voltage Module, 24 TPs
MPX-3-200 200 Test Point Module
MPX-5-200 200 Test Point High Performance Module
PWR-2 Power Module
SMT-2 TestJet with 24-Channel SMT / Capacitance Polarity Capability
System Spare Parts Kits
TR-6-1 50 Test Point Relay Expansion Module
USB-GPIB USB to IEEE-488 Interface

emsV12 Specifications

Resistance Measurement

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

Measurement using DC Current Stimulus

Range F.S.	Current	V at F.S.**	Accuracy*
19Ω[1]	10mA	200mV	1% ± 0.2 Ω
190Ω[1]	10mA	2 V	1% ± 1 Ω
	1mA	200mV	0.5% ± 0.2 Ω
1.9KΩ	1mA	2 V	0.5% ± 1 Ω
	100uA	200mV	0.5% ± 2 Ω
19KΩ	100uA	2 V	0.5% ± 10 Ω
	10uA	200mV	0.6% ± 20 Ω
190KΩ	10μA	2 V	0.6% ± 100 Ω
	1μA	200mV	1.5% ± 200 Ω
1.9MΩ	1μA	2 V	1.5% ± 1k Ω
	100nA	200mV	3% ± 2k Ω
19MΩ	100nA	2 V	3% ±10K

1. 4-wire measurement mode. For internally sensed measurements, add 2Ω to accuracy.

*All accuracies specified as a percentage of the measured value.

**Maximum voltage may exceed full-scale value during over-range.

Measurement using AC/DC Voltage Stimulus

Range	Peak Stimulus V	Accuracy
0Ω to 10KΩ	2 V	0.5% ± 0.5Ω
	200mV	1% ± 0.5Ω
	100mV	2% ± 1Ω
	50mV	5% ± 2Ω
10KΩ to 100KΩ	2 V	1%
	200mV	2%
	100mV	4%
	50mV	10%
100KΩ to 1MΩ	2V	2%
	200mV	4%
1MΩ to 10MΩ	2 V	5%

For internally sensed measurements, add 2Ω to accuracy. Available AC stimulus frequencies 100Hz and 1KHz. Source current is less than 10mA with MPX-3, less than 14mA with MPX-5.

Capacitance Measurement

Capacitors can be measured with either DC-constant-current or AC-complex-impedance measurements. Effective measurement range is 2pF - 20,000μF [5].

Range (DC Current) — Accuracy

(1mA)	2V	200mV
50 uF - 500 uF	4%	---
500 uF - 5 mF	---	10%

(10mA)	2V	200mV
500 uF - 5mF	4%	---
5mF - 20 mF	---	10%

100 kHz	2V	200mV	100mV
0 - 100 pF	4%[1]	10%[2]	20%[3]
100pF - 1nF	4%[2]	10%[3]	20%[4]
1nF - 10nF	10%	20%	---

10 kHz	2V	200mV	100mV
0-100pF	4%	10%	20%[3]
100pF - 1nF	4%[2]	10%[3]	20%[4]
1nF - 100nF	4%	10%	20%
100nF - 1uF	10%	---	---

1 kHz	2V	200mV	100mV
0-100pF	4%[1]	10%[2]	20%[3]
100pF - 1nF	4%[2]	10%[3]	20%[4]
1nF - 10nF	4%	10%	20%
10nF - 100nF	4%	10%	20%
100nF - 1uF	4%	10%	20%
1uF - 10uF	4%	10%	20%
10uF - 100uF	10%	---	---

100 Hz	2V	200mV	100mV
100pF - 1nF	10%[2]	---	---
1nF - 100uF	4%	10%	20%
100uF - 1mF	10%	20%	---
1mF - 20mF	10%	---	---

Notes:

1. ± 5pF
2. ± 10pF
3. ± 20pF
4. ± 40pF
5. 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. Technique is fully auto-ranging. AC source current is less than 10mA.

Inductance Measurement

Inductors are measured with AC-complex-impedance measurements. Effective measurement range is 1μH - 1000H. Add 1uH per Ohm of DC resistance

Range

100 kHz	2V	200mV	100mV
0 - 10uH4%[1]	10%	20%	
10uH - 100uH	4%[2]	10%	20%
100uH - 1000H[4]	---	---	---

10 kHz	2V	200mV	100mV
0 - 10uH4%[1]	10%	20%	
10uH - 100uH	4%[2]	10%	20%
100uH - 10mH	4%	10%	20%
10mH - 100mH	10%	20%	---

1 kHz	2V	200mV	100mV
0 - 10uH10%[2]	---	---	
10uH - 100uH	10%[3]	20%	---
100uH - 100mH	4%	10%	20%
100mH - 1H	10%	10%	---

100 Hz	2V	200mV	100mV
100uH - 1mH	10%	---	---
1mH - 1H4%	10%	20%	
1H - 10H10%	10%	20%	
10H - 100H10%	20%	---	
100H - 1000H	20%	---	---

Notes:

1. ±0.5uH
2. ±2uH
3. ±4uH
4. Not recommended

External sense for <100uH measurements

Guarding

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

Typical Resistance Measurement Accuracy Degradation when using Guarding:

Guard Ratio Accuracy	Multiply
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
20V	10mA	±300mV

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DC Voltage Measurement

DC Voltage Measurement (VOLT test type)

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

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

The system can measure VDC up to ±250 volts on the UUT using the DMM test type and MPX-2 nodes

DC Voltage Measurement (DMM test type)

Ranges**	200mV, 600mV, 2V, 6V, 2V, 60V, 200V, 600V (max input 250V), auto-range
Accuracy	0.5% of range
Resolution	0.05% of range

** Maximum voltage connected to MPX points must not exceed ±12 volts with respect to the controller chassis. Maximum voltage applied to test points must not exceed ±250 volts with respect to the controller chassis. The LOW bus can be connected to the controller chassis during a DMM test under software control.

AC Voltage Measurement (DMM test type)

Ranges**	200mV, 600mV, 2V, 6V, 20V, 60V, 200V, 600V (max input 250V RMS), autorange
Accuracy	2% of range (40Hz to 1KHz) 5% of range (1KHz to 10KHz)
Resolution	0.05% of range
Input	AC or AC+DC Coupled

** Maximum voltage connected to MPX points must not exceed ±12 volts with respect to the controller chassis. Maximum voltage applied to test points must not exceed ±250 volts with respect to the controller chassis. The LOW bus can be connected to the controller chassis during a DMM test under software control.

DMM Measurement Information

Voltage Levels	The DMM can take fully floating differential measurements.
Measurement Speed	~60msec. (AC readings and filtered DC readings ~500msec.)

DMM from FUNC-2B

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 400 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 (slower 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

Discharge

Discharge Load	250Ω
Discharge Threshold	5V typical
Maximum Discharge Voltage	250V

Sourced from MPX-2

Voltage Sourcing

Low Power Sourcing

DCV 1 and DCV 2

Amplitude	–10V to +10V in 5mV steps
Accuracy	1% ±5mV
Test Point Source Resistance	< 1KΩ

Sourced from FUNC-2

DCV 5

Amplitude	–10V to +10V in 80mV steps
Accuracy	±0.3V
Test Point Source Resistance	< 1KΩ

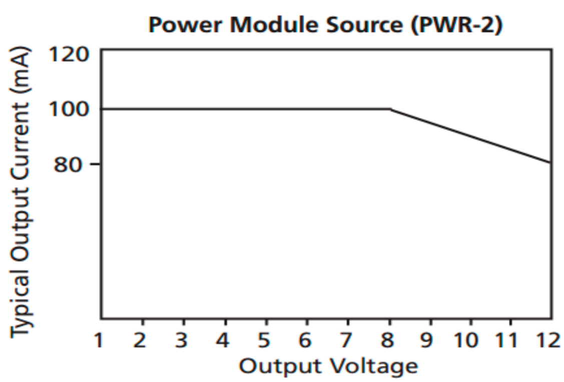
Sourced from V12

High Power Sourcing

DCV 3 and DCV 4

Amplitude	–12V to +12V in 6mV steps
Accuracy	3% ±0.05V when not in current limit
Test Point Source Resistance	< 4Ω

Sourced from PWR-2



Current Measurement Accuracy	10% ±2mA
Voltage Measurement Accuracy	3% ±0.05V when in current limit

DCV 6

Amplitude	+5V or +12V controller chassis referenced
Current	Limited by resetable fuse with <8Ω resistance at 0.145A at 20° C.

Sourced from MPX-2

Constant Current Sourcing

Low Power Sourcing

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

Sourced from V12

High Power Sourcing

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

Sourced from PWR-2

Function Generator Waveform Sourcing

All three stimuli are available simultaneously with some limitations (sine and square frequencies must match, square wave must be UUT ground-referenced). When switched through the solid-state test points, the total path resistance is 1KΩ or less. Each function generator output can source up to 10mA into low impedances, but the current/voltage is limited by the switch resistance.

Functions	DC Voltage / Sine Wave / Square Wave
Frequency Range	DC, 1 Hz - 100 KHz
Common	UUT ground-referenced
Frequency Accuracy	.01%
Amplitude Accuracy	1% of full scale (DC) 5% of full scale (20Hz to 1KHz) 10% of full scale (1KHz to 20KHz)
Sine Amplitude	100mV to 20Vp-p (0.1dB steps)
Square Wave Amplitude	Each level programmable from –10V to +10V (5mV steps)
DC V Amplitude	Programmable from –10V to +10V (5mV steps)
Source to	Solid state bus and unswitched at fixture interface

Sourced from FUNC-2

DIGITAL I/O

Available on the rear connector of the V12 are 8 digital I/O bits with LVTTL capability.

Number of Bits	8
Logic Level	V(IL) : -0.5V/0.8V V(OL) : 0.4V(max)
	V(IH) : 2.0V/4.1V(max) V(OH) : 2.4V
Output Source	± 12 mA

Sourced from V12

Available are 96 dedicated test points (two DIG-1 modules with 48 points each). 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	96 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 and 8 on FUNC-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 and FUNC-2

Power Supplies

Dedicated High Power(Up to 4 can be added)

PS-UUT-L2 Programmable power supplies:

#1:	0 to 60VDC, up to 12.5A
#2:	0 to 60VDC, up to 12.5A

The PS-UUT-L2 voltage output has remote sense and progammable current limit. Total power should not exceed 750 watts for each unit.

PS-UUT-L2 Accuracy:

Voltage Output	0.05% of Vout + 30mV
Current Output	
Iout > 50mA to 12.5A	0.10% of Iout + 25mA
Iout < 50mA	0.10% of Iout + 50mA

Dedicated Low Power Outputs

FUNC-2B	12V @ 1A, 5V @ 1A, –12V @ 0.1A fused and switched
PWR-2A	12V @ 1A, 5V @ 1A, –12V @ 0.1A fused and switched
DIG-1	5V @ 1A fused and switched

Undedicated Relays

FUNC-2	4 SPDT, 1A relays, less than 2Ω lead resistance
PWR-2	4 SPDT, 1A relays, less than 2Ω lead resistance
PS-1	24 N.O. SPST, 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. 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.

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 400-point 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 V12 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 ISP system, Boundary-Scan, 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 greater than 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.

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