

Analyst *ils*

In-Circuit
Test System



CHECKSUM ✓

Affordable test for manufacturing

CheckSum test systems utilize sophisticated capabilities such as guarding, complex-impedance measurement, vectorless test with TestJet Technology*, in-system programming, 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 2000 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.

CheckSum Analyst *ils* In-Line Test System

Product Features

- In-Circuit Test
- TestJet Technology
- Windows 2000 Visual Test System Software
- SMEMA Compatible
- Pneumatic Actuation with Integrated Cabinet
- Top and Bottom Probing Fixture System
- Bed-of-Nails Test Fixtures
- 2000 Test Point Capability

Applications

- **Through-hole and SMT Assemblies**
- **Analog and Digital Assemblies**
- **Individual or Panelized PCBs**
- **In-System Programming (ISP)**

The CheckSum **Analyst *ils*** can be easily integrated into an automated test line. The System combines process testing with TestJet Technology to test a single assembly or a panel of multiple assemblies.



Analyst ils in UUT Loading Position



Analyst ils (side angle view)

The **Analyst *ils*** tests the entire unit-under-test (UUT) and individual components without power applied. Using sophisticated measurement techniques such as DC or complex-impedance measurements in conjunction with 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.

Checksum Analyst *ils* In-Line Test System

The **Analyst *ils*** is designed to be used for most common through-hole and SMT circuit assemblies. It can perform effective power-down testing for most analog or digital assemblies being manufactured today. The optional power-up functional test capability is ideally suited for lower frequency analog assemblies with some digital content.

Operating the System

The standard **Analyst *ils*** is provided with a stand-alone long-travel pneumatic fixture press built into the cabinet. This unit can be installed on your factory floor, and is ready for use once connected to standard compressed air and an AC outlet. The standard configuration is complete for most testing operations.

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.

To configure the system for testing, easily removable, fixture kits are installed without the need for tools. Using standard SMEMA interface connections, the **Analyst *ils*** coordinates loading the UUT from the previous machine, testing it, and then passing it on to the next machine in the line. The system will be setup to automatically start each test. Once the test is completed, the system displays the results and automatically releases the UUT. The UUT will be automatically moved to the next machine when ready. The system can be configured to automatically save the test results for statistical analysis (SPC) with included software.

Providing features such as periodic sampling of UUTs passing down the line and automated recompression of probes and/or automatic retesting on failures, the **Analyst *ils*** meets sophisticated testing needs.

Power-Down Test Capabilities

For 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 well 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 10 Ω range, but can be programmed over the range of 2 Ω to 50K Ω . Continuity tests can use either 10mA, 1mA or 100 μ A 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 0 Ω up to 19M Ω using various techniques to optimize the measurement effectiveness. You can choose between using a constant-current source (0.1 μ A to 10mA), a DC constant-voltage source (.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 20,000 μ F. 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 μ H up to 1000H. Measurements are made by using complex-impedance measurements with stimulus frequencies between 100Hz and 100KHz and full-range amplitudes of 0.02V 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, DC amplitudes up to 10 volts can be measured. Fully differential measurements can be made up to \pm 8V from chassis ground.

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 can not 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 (0.1 μ A 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 (0.1 μ A 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.

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 presence.

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 200 μ F.

AutoLearn and Test

To test UUTs without programming, CheckSum offers the 'AutoLearn' 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 ils* system includes 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

Checksum Analyst *ils* In-Line Test System

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 back panel. These outputs can be switched on or off via on-board relays. The outputs 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.

Digital Test Capability

Digital I/O

The standard configuration of the *Analyst ils* includes 48 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 10K Ω 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 ils* can be configured with the optional Boundary-Scan Test. 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.

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/DIG-1)

System Switching Topology

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

The system uses a 800 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 $\pm 12V$ referenced to the computer chassis.

A 16 x 2 relay matrix is also included for signals in excess of 10mA, or for voltages greater than $\pm 12Vdc$ (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.

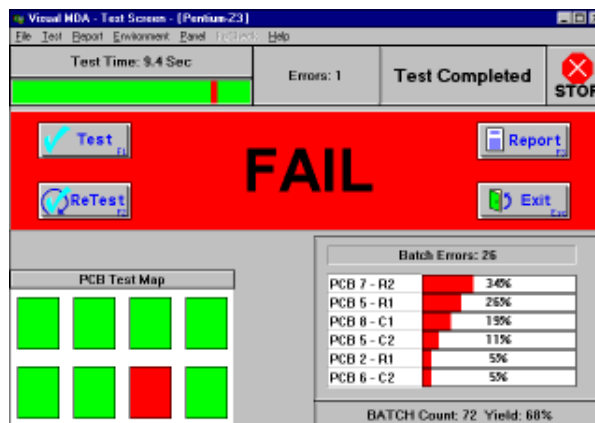
System Software

The system comes complete with a comprehensive, yet easy-to-use software package. Running in the Windows 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

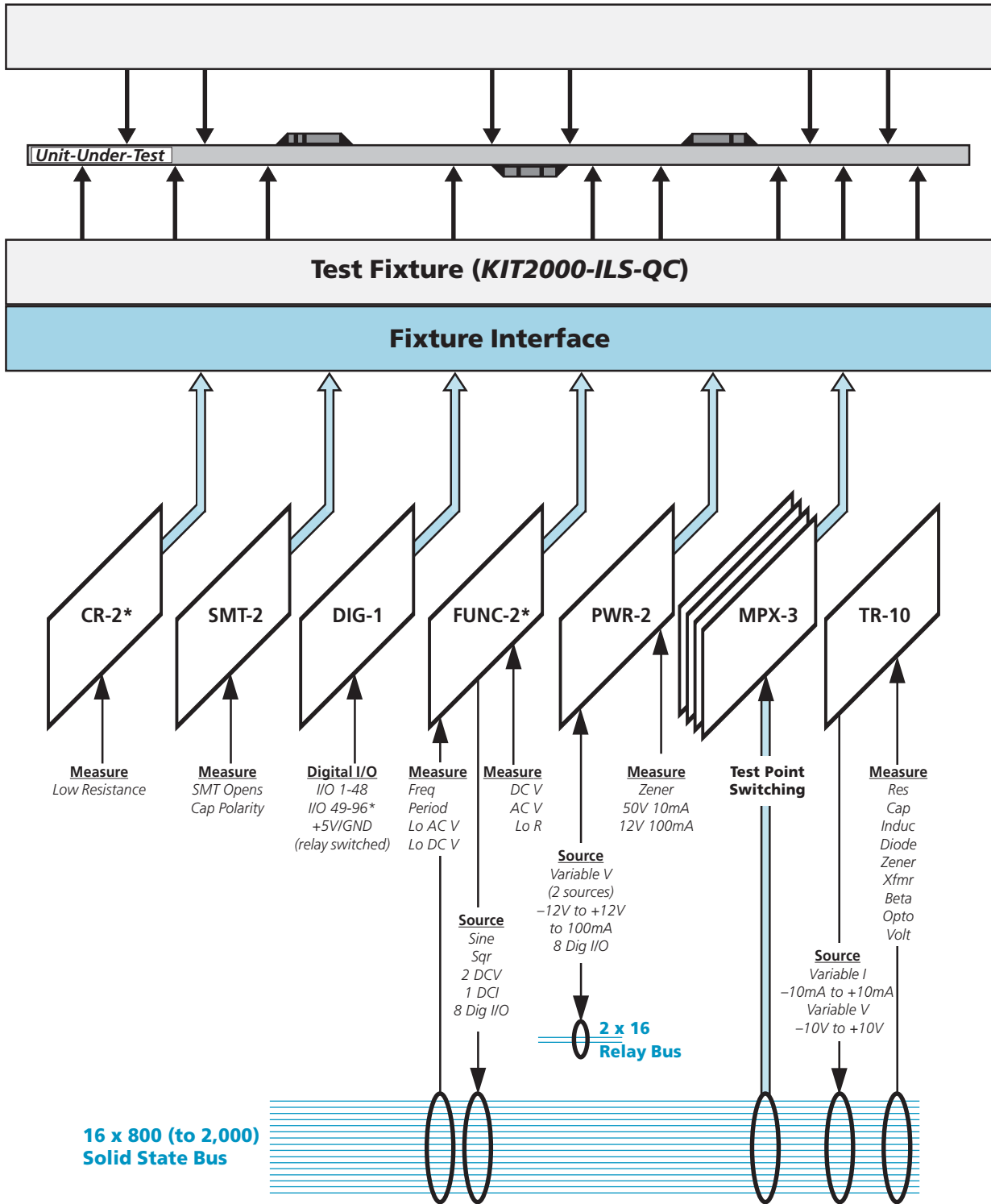
The system can be setup to accommodate a variety of philosophies about how to present production quality control data.

In the most simple case, 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 system can be configured to automatically ReTest the assembly multiple times (front panel switch controlled) or move onto the next UUT.

CheckSum Analyst *ils* In-Line Test System



* optional module

Checksum Analyst *ils* In-Line Test System

Paperless repair, including built-in serial number tracking, is normally used in an automated in-line testing environment.

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.

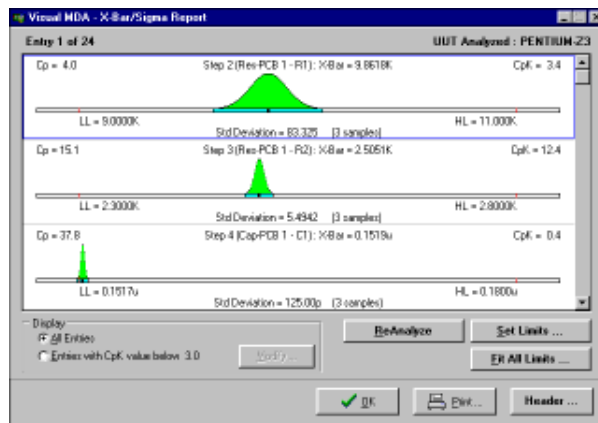
Statistical Process Control

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.

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.

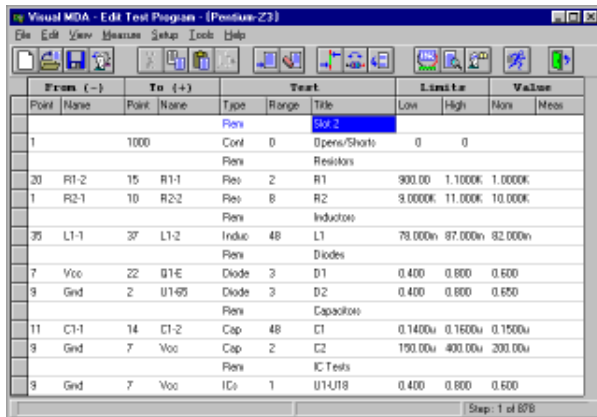
Test programs are generated in an interactive spreadsheet-like environment, with each line specifying one test step. Typical test steps include RES (resistance test), CAP (capacitance test), CONT(inuity test), JMPx (jump based on some conditional), MEMx (memory math), RELAY (specify relay closure), DIGO (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

Checksum Analyst *ils* In-Line Test System

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.

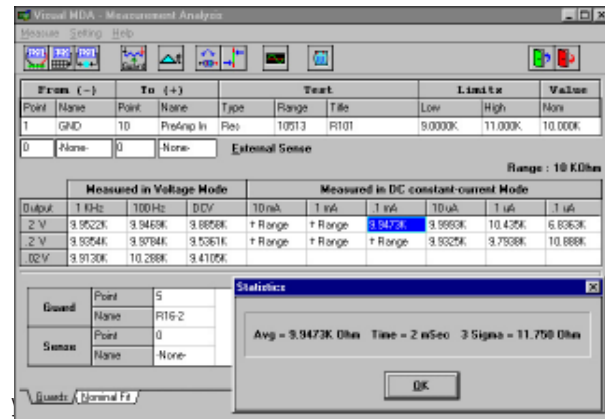
Each test program can have up to 30,000 test steps, and test programs can be transparently linked together to provide unlimited length programs, or to allow you to make libraries of program segments that you can reuse.



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 and Fabmaster. 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 measure-

ment 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



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.

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

Checksum Analyst *ils* In-Line Test System

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 CRT). 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 standard **Analyst *ils*** consists of a complete, ready to use, 800-point system with:

- 1 TR-10-2K System Electronics with Test System Software
- 4 MPX-3-200 200 Test Point Modules
- 1 SMT-2 TestJet Technology Module and License
- 1 PWR-2 Power Module
- 1 DIG-1 48-Pin Digital I/O Module
- 1 CM-3-KIT-ILS Calibration/Verification Fixture
- 1 PPC2ICU Panel PC and Industrial 14-slot Chassis
- 1 T-120-2P Printer
- 1 Handler with Pneumatic Fixture System

Options/Accessories

The system can be configured with additional modules and other options that can expand the system to 2000 test connections.

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

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	2V	1% F.S.
1.9KΩ *		1mA	2V	1% F.S.
19KΩ *		0.1mA	2V	1% F.S.
190KΩ *		10μA	2V	1% F.S.
1.9MΩ *		1μA	2V	2% F.S.
19MΩ		0.1μA	2V	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 & 0.02V sources are also available. For 0.2V, multiply accuracy by 3. For 0.02V, 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 <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%+.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:

- ± 5pF
- ± 10pF
- 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 than 10mA.

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.

CheckSum Analyst *ils* In-Line Test System

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 100mA of applied current.

Diode Test Type

Accuracy

Range	Source Current		
	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 up to 8V from 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 400 Test Points	1-2 seconds

(Test time depends on UUT circuit topology)

Low Threshold Continuity (rated speed)

Range	Threshold
1mA	2Ω to 50Ω
10mA	1Ω to 10Ω

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

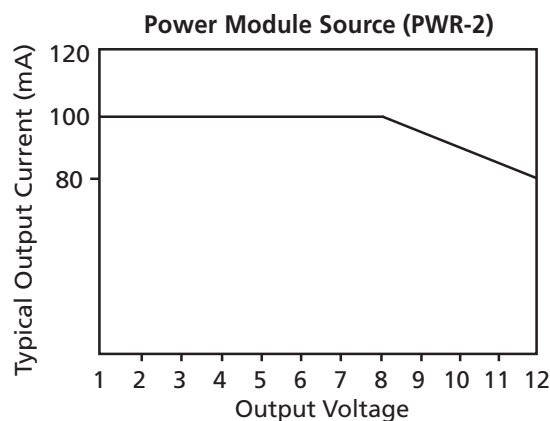
Sourced from TR-10

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

Digital I/O

Available are 48 dedicated test points (DIG-1 module with 48 points, optionally 48 additional). 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

CheckSum Analyst *ils* In-Line Test System

Power Supplies

Dedicated Low Power Outputs

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

Undedicated Relays

PWR-2	4 SPDT, 1A relays, less than 2Ω lead resistance
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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. 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 probe 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. The SMT-2 can test up to 24 capacitors on a UUT.

General Notes

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 800-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 TR-10 system electronics.

Fixture Press

Press Stroke	5.9"
Press Force	880 lbs.
Size / Space	35.4" wide, 30.3" deep, 82.7" tall (including light pole) plus recommended front/back clearance of 36"
Maximum Probes	2000
Machine Weight	605 lbs. (add approximately 80 lbs. for typical test controller/electronics)
Shipping Weight	Approximately 770 lbs (plus approximately 80 lbs for typical test electronics when installed)
Warranty	90-day parts and labor limited warranty

UUT

Maximum size	13.4" wide (direction of travel) x 10" deep
Component Height	Pressure rods top-side are 0.75" long to accommodate most UUTs without top plate routing. Components topside up to 2" can be accommodated with top-plate routing. Components bottom side can be accommodated up to 1.25" in height with probe-plate routing.
Tooling Holes	Edge of tooling holes in UUT must be minimally 0.120" from conveyer-driven edges of UUT. Recommended size 0.125", 0.137", or 0.156" diameter.
Probing	Top-side and/or bottom-side

Conveyer

Height	Adjustable 37"-38" from floor
Z-Travel	1.968"
X-Travel	Left to right
X-Speed	30 - 312 inches/minute
Width	Front rail fixed, rear rail adjustable from 4" to 10"
Rail Width	0.120" (width of UUT edges inaccessible)

Facility Requirements

Pneumatic Requirements	100 - 120 PSI standard shop air
AC Lines Input	Operates on 115V, 60 Hz, 15A circuit
Earth Ground	0.250" diameter earth ground lugs provided each end
Clearance	Recommended front/rear clearance: 36"
Environmental	40-90 degrees F, 0-80% relative humidity, non-condensing

Indicator Panel

Pass/Fail	Show status of last test performed, or when testing, current status of UUT
Check	Test in progress, system busy
Manual/Auto	Mode that system is in, automated or manual control
Press Down	Indicates that the probes are engaged

Conveyer/Press Panel Controls

Speed Control	Allows continually variable conveyer speed from 10% to 100% speed.
Emergency	Shuts off power to system. Turn-to-release control. The system halts when this is pressed. Once it is released, it is necessary to manually reset the system by pressing Buzzer Reset on this panel, then Reset All on the Power panel.
Conveyer Start	Commands the conveyer to start if it is halted, and to stop if it is active. This control is only active when the Auto/Man control is in Man.
Conveyer Up	Commands the conveyer to go up to the normal load/unload position. This control is only active when the Auto/Man control is in Man.
Conveyer Down	Commands the conveyer to go down to the test position, allowing the press to go down when requested. This control is only active when the Auto/Man control is in Man.
Press Up	Commands the press to go up, disengaging the probes. This button must be held until the conveyer is fully up.
Press Down	Commands the press to go down, engaging the probes. Press Down does not operate unless the Conveyer is down and the Press Down button on the Power panel is also simultaneously held.
Reset Buzzer	Turns off the buzzer located in the light pole. If the Emergency switch has been pressed, this button also releases the emergency stop state.

Power Panel Controls

Reprobe Cycles	Sets the number of times (0-15) to re-engage the probes prior to testing. Can be used to break through fluxes or contaminants on the UUT.
ReTest Cycles	Sets the number of times (0-15) that the system will try a retest in the event of a failure. The entire test of the UUT is first run, and then if retests are specified, the steps that failed are tested again. The Analyst ils pass/fail signal at the SMEMA interface is set based on the final test or retest of the UUT.
Sample Frequency	Sets a sampling rate (0-15) for the UUT. If zero, all UUTs are tested. If non-zero, specifies how many UUTs are skipped between tests.
Auto/Manual	Sets the machine to manual or automated operation. Normal testing mode is Auto. For manual control, set to Manual which activates the conveyer, press and stop controls.
Press Down	Toggles between engaging and disengaging the UUT probes (only active in Manual Mode). To make the press go down, the Press Down button on the Conveyer/Press Panel must be pressed simultaneously. The press will not go down unless the conveyer is already in the down position.
Auto Start	Used after power up, an error condition, or after changing from manual to automatic control to start automatic operation.
UUT Stop	Engages or disengages the mechanism which stops the UUT on the conveyer when it is in the test position. On enables the stop, Off disables the stop.
Reset All	Commands the system to go to the initial power-on state. After Reset All, set the Auto/Man control to Man and use Press Up and Conveyer Up controls to release the UUT that was being tested at the time Reset All was selected.
Power	Turns power on and off to the system. The main system breaker in the lower right of the system must first be turned on for this switch to be active. The Power switch has a clear safety cover that needs to be lifted prior to using the switch. The switch illuminates when power is turned on.

CheckSum Analyst *ils* In-Line Test System

Model KIT2000-ILS-QC Fixture Kit

Includes:

- Top and bottom plates
- Ten (10) pressure rods (0.75" long)
- Bottom connector interface plate (unpopulated) with provisions for 2000 test points
- 50 pin system control block connector
- Two (2) fixture kit alignment pins and bushings
- Fixture storage kit

Inside Depth	3.217" (between bottom fixture kit plates)
Probe Count	Up to 2000
Weight (Kit)	Approximately 25 lbs (shipping wt. approximately 30 lbs)



KIT2000-ILS-QC Fixture Kit

Notes

Fixture kit is designed for spring-probe socket set-height of 0.200" with standard 0.062" thick UUT circuit board.

Fixture Accessories

Model	Description
FIX-250P-WB	250 test point fixture wiring block
IL-ROD-0750	Blunt Pressure Rod
IL-ROD-0750-T	Tapered Pressure Rod
1900-428	Fixture Kit Top Spacer (1.768" long)
1900-431	Fixture Kit Bottom Spacer (3.217" long)



KIT2000-ILS-QC with two optional FIX-250P-WB



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Specifications subject to change (8/2006)