Analyst mc

CHECKSUM

MDA In-Circuit Test System

CheckSum Analyst *mc* MDA Test System

Product Features

- MDA Power-off In-Circuit Test
- Bed-of-Nails Testing
- Compact Design
- Low-cost, Quick-Change Fixturing
- 400 Test Points
- Top and Bottom Probing
- Single-Action Engagement
- Powerful Visual MDA™ Software

Applications

- ***Most Common Circuit Assemblies***
- ***Through-hole and SMT Assemblies***
- ***Analog and Digital Assemblies***
- ***Individual or Panelized PCBs***

The CheckSum Analyst *mc* is designed to provide comprehensive testing of circuit boards to find manufacturing faults such as incorrect or missing components, assembly errors, and opens and shorts. By testing prior to power-up, the great majority of faults can be found as early as possible in the manufacturing cycle, with good diagnostic information.

Analyst mc in UUT-Loading Position

Analyst mc Performing Test

By combining CheckSum's proven software, test electronics, and fixture interface from our more expensive systems into a compact integrated system, the Analyst *mc* is the definitive test solution for ease of operator use, high test coverage, and cost-effectiveness. The Analyst *mc* makes it possible to provide testing in applications previously not cost-effective for test, or in applications requiring multiple testers. There are no other test systems on the market that provide as much test coverage per dollar spent.

As America's leader in MDA test systems, CheckSum offers first-class customer support and service. When you call the factory, you can talk to qualified engineers to answer your questions. There are no hidden costs for software updates, maintenance and support. We are here to help.

System Overview

The Analyst mc is designed to be placed on a bench top, using only a small amount of space. The monitor is placed on top of the Analyst mc, with the normal operator controls and indicators on the front panel. The only external resource necessary is standard 115/230VAC power.

For each assembly (or family of similar assemblies) that you will be testing, a custom bed-of-nails fixture is built and programmed. This can be done internally, through CheckSum's fixturing department, or by a local third-party supplier. The test fixture is based on a compact, inexpensive fixture kit that will accommodate units-under-test (UUT) up to about 8.5" x 11.75" with up to 400 nodes (test points).

To change fixture kits, a latch releases the bottom of the kit so that it can be lifted out. The top plate unclips from detents for easy removal. Likewise, the new kit is latched into place. The entire fixture change operation takes a few seconds. There are no cables or wiring to deal with because of CheckSum's innovative Quick-Change interface.

To test, the UUT is first placed in the system, usually onto guide pins that fit into tooling holes in the UUT. The operator then uses the actuation lever on the side of the Analyst mc to move the top plate down, compressing the spring probes. Once the probes are engaged, the system automatically starts the test. When the UUT test is completed (most UUTs require a few seconds of test time), the operator is given a pass/fail indication on the monitor and front panel LEDs. The actuation lever is then lifted to release the UUT and move the top plate back and up. The UUT is removed and the system is ready for the next UUT. Alternative testers typically require additional operator actions to load and unload since lids and over-clamps are often used.

With the optional printer, the system can output test reports, either upon operator request or automatically. You can obtain a failure report on failed assemblies to associate with the assembly for repair. The system also can log detailed test results for statistical process control (SPC).

Electrical Capabilities

The Analyst mc provides testing that is both high-speed and comprehensive. The system allows any point to be tested against any other point for measurements such as resistance, opens/shorts, capacitance, voltage, inductance, transistor beta, transformer polarity, IC presence/orientation, opto-isolator and diode junctions tests. Tests can incorporate a number of test points at one time. For example, a single measurement may have source high and low test points, separate sense high and low test points, and multiple source and sense guard channels - all active at one time. Typical measurements take about 2 to 25 mSec, but can be longer with some measurement methods or if the UUT points need to be charged or discharged. Most complete MDA tests are well under ten seconds.

Opens/Shorts

Shorts and opens are tested by testing each point to each other point, using low thresholds, such as 10Ω. Thresholds can be programmed to values between 2Ω and 50KΩ. Pairs of points can also be specified as "no-cares" to ignore point pairs tested elsewhere.

Resistance Measurements

The Analyst mc can measure resistance values from 0Ω up to 19MΩ. It provides various measurement techniques so that the best method for a particular circuit can be used. Techniques such as voltage stimulus (constant-voltage, measure-current), current stimulus (constant-current, measure-voltage), and AC complex-impedance can be used. Various frequencies, currents and voltage ranges can be selected to optimize each measurement for speed and/or accuracy.

Capacitance Measurements

The Analyst mc can measure capacitance values from a few pF to 20,000µF. This is done by using one of two techniques. For large capacitors, a pulsed DC-current is used to determine the capacitance value. For smaller capacitors, AC complex-impedance measurements can be used with multiple frequencies and voltage ranges available for the measurement.

Inductance Measurements

Inductors are measured using AC complex-impedance techniques. Inductor values from a few µH up to 1000H can be measured. Multiple measurement stimulus frequencies can be selected, as well as different output amplitude ranges in order to optimize measurement effectiveness.

Parallel Components

In typical in-circuit measurements, parallel circuitry in the UUT can affect the measurements of some components. To deal with this, the Analyst mc provides guarding capability. Guarding allows additional test points to be

used to precisely source and sink current in parallel path junctions. This guard current can reduce or eliminate the parallel effects of the circuitry so that the measured component is isolated. Up to six individual guard channels can be used, or all points can be specified.

The IC pins on a node often have diode junctions that can interfere with measurements. To avoid this problem, the Analyst mc offers measurement ranges that operate at levels lower than the IC diode junction turn-on voltage.

Complex-impedance measurements will usually resolve individual components even without guarding. For example, a resistor measured in parallel with a cap will often give proper component results depending on the ratio of the impedances.

Transistor/FET Testing
Transistors and FETs are tested by applying a stimulus between the power leads, and sweeping a current or voltage into the control lead. The system then detects the turn-on point. This will determine correct polarity where often a dual-diode test will not.

Opto-Isolators
Opto-isolators are tested by stimulating the input stage while monitoring the output stage conductivity.

Diodes
The Analyst mc can measure diode junctions using different sourcing currents up to 10mA. This allows it to detect presence and polarity of diodes.

Zener Diodes
Zener diodes up to 20 volts can be measured. The system provides up to 10mA of current to force the zener to go into its operating region.

LEDs
LEDs are tested like signal diodes, but normally have higher forward-voltage drop.

Transformer Polarity
Transformers can be tested to see if the input and output coils are polarized properly with respect to one-another. This can find common faults when wires on transformers are hand-soldered.

IC Presence/Orientation Test
IC's are tested for presence and orientation by testing pins of ICs from power and ground. This measurement of the internal protection diodes can often find IC installation problems if the diode mapping is different as a result of the wrong, missing, or incorrectly oriented IC.

System Software

Even though the Analyst mc is low-cost, it is complemented by a highly sophisticated software package. Based on the Windows operating system, the Visual MDA software package includes features that are usually optional on bed-of-nails testers, even on much more expensive systems. It includes a complete programming system with CAD conversion utilities, the test executive to control testing, and statistical process control (SPC) software for production and fault analysis. Test programs written (and in some cases test fixtures) for the Analyst mc are compatible with other CheckSum MDA test systems.

Test Programming Capabilities

The Analyst mc includes a complete test program generation package. There are several levels of programming support available. When creating a test program, the programmer plugs an included keyboard and mouse into the system. In most cases, test programming is done by a technician or test engineer, or can be contracted to CheckSum or a third-party; usually in conjunction with building the test fixture.

Test programs for the Analyst mc can simply include a few measurements, or can include a host of sophisticated capabilities such as jumps based on measurements or operator input, math operations, file input/output, and execution of external programs. On-line help is available to aid the programmer.

Panelized assemblies are accommodated by display of pass/fail and test results of each UUT in the panel, ability to skip individual PCBs, and step and repeat programming.

Autoprogram

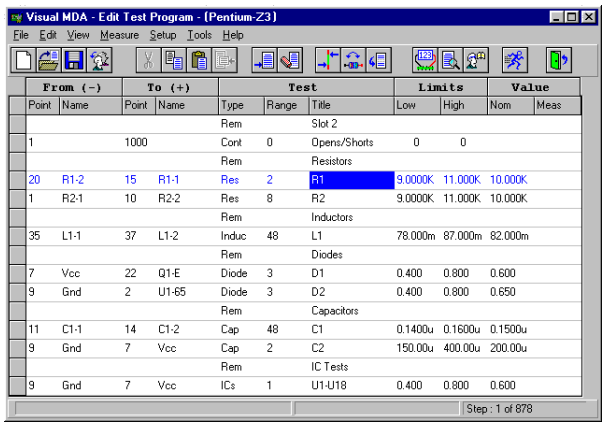
Autoprogramming can be used to quickly start testing. By automatically analyzing a known-good UUT, it finds resistances, capacitances, opens/connections map, and diodes. This allows you to start testing quickly, but with limited diagnostic capability in the case of faults.

Interactive Test Program Entry

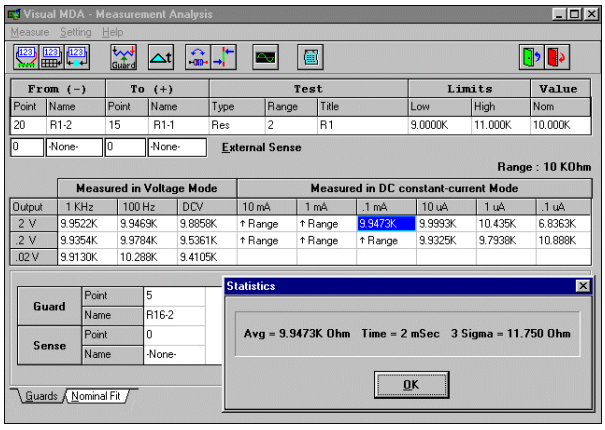
For many assemblies, the easiest way to write programs is by manually entering the test steps. The program editor, which looks similar to a spreadsheet, is filled in with a test step on each line.

A typical line might contain the test type (e.g., resistance), the name of the component being measured (e.g., R1), the two test points (along with descriptive test

point names), the measurement range, the nominal value, and the high and low test limits.



Once the line is entered, the programmer can interactively execute the line, and use the extensive tool set to help fine-tune the test. For example, if not satisfied with the automatically generated test range, the programmer can display the outcome of all measurement techniques and ranges, then choose the best one. Also available are statistics about the measurement, such as mean (average) reading, measurement speed, and measurement standard deviation.



Some of the measurements are automatically generated by the system. Two examples are the continuity and ICs orientation maps. The system can also automatically determine ranges and techniques (including guard pins) that it finds appropriate.

CAD Conversion

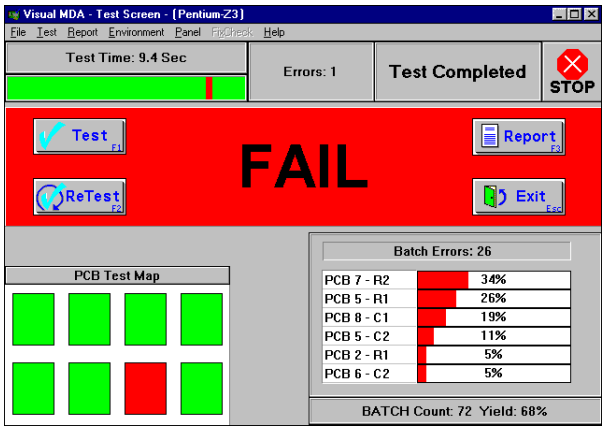
If you have CAD data available for your UUTs, the system can use it to help generate the test program. Most popular CAD systems are supported by the system, such as OrCAD, P-Cad, Mentor, HP-BCF, Cadence, Racal-Redac, Viewlogic, Tango, Veribest, ComputerVision, Pads2000, and Scicards. By reading the net-list and component data from these systems, the Analyst *mc* generates a test program that is ready for final debugging as described in the previous section.

Test Execution Capabilities

The Analyst *mc* is designed to be easy to use and intuitive to the test operator.

In the standard mode of operation, the operator simply puts the next UUT in place, moves the actuation lever, and the test automatically starts. At the end of the test, the Pass/Fail status is indicated on the monitor and front panel LEDs, the operator moves the actuation lever to the rear, and removes the UUT.

If higher-skilled operators are used, you can configure the system to use switch input to start a test or retest, and to allow halt-on-fail testing. The screen can also include a real-time Pareto chart to quickly see if there are a predominance of particular failures in the current production batch.



The optional system printer can be configured to output failed results automatically upon failure so they can be attached to the UUT to aid in repair. A front panel key can also be used to obtain a test report. Reports can be configured to include only information important to you.

Multi-Tester Probe Inputs

The Analyst *mc* has front panel test inputs that can be used for device troubleshooting, probing test points, testing two-terminal devices in non-bed-of-nails applications, or to contact points on the UUT that are not accessible by spring probes.

The Test Input probes can measure capacitance, inductance, resistance, DC voltage (up to 10VDC), diode junctions, and logic high/low.

A front panel ground banana jack can be used to ground the operator's wrist-strap for ESD control.

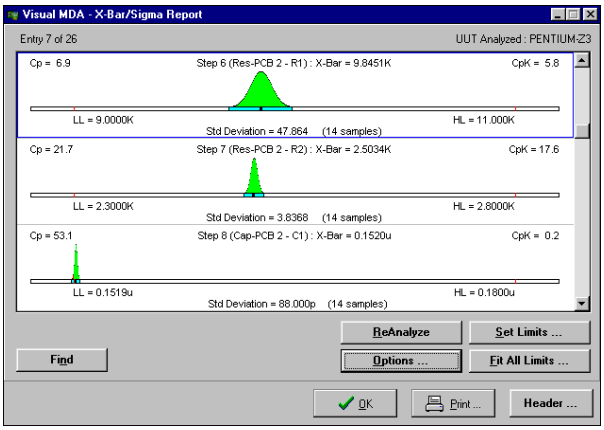
Statistical Process Control

The system software contains a comprehensive SPC package. In addition to the standard test reports available after each test, the system can log detailed information about testing. You can use the included CheckSum software to obtain reports, or use the raw ASCII data in other applications (such as your spreadsheet software) for custom analysis.

The Production report allows you to obtain, over a selected period of time, and with all UUTs or a selected UUT type, information such as how many were tested, how many failures occurred, and consequent yield.

The Pareto Failure report presents failure data sorted by frequency. This can be used to analyze your processes, addressing the biggest problems first.

The X-Bar/Sigma report gives you detailed analysis of analog measurements taken by the system. By plotting X-bar, standard deviation, 3-sigma, Cp and Cpk, you can analyze measurements during programming for optimization, or if you are measuring process output, you can find trends in the process.



System Configuration Software

The Analyst *mc* contains a very flexible software environment. The system software allows you to self-test the hardware, specify report configuration, auto report generation configuration, password protection and user names, test environment, along with other system parameters. With this software, you can customize the system setup to best fit your testing needs and operator skills.

Partial List of Test Types

RES	Measure resistance
CAP	Measure capacitance
DIODE	Measure semiconductor junction voltage
INDUC	Measure inductance
ICS	Test for IC orientation/presence (entire UUT)
CONT	Opens/shorts continuity test (entire UUT)
XFMR	Check Transformer Polarity
BETA	FET/Transistor Operation Test
OPTO	Opto-isolator Operation Test
VOLT	Measure a DC voltage
PAUSE	Pause specified number of milliseconds
DISCHARGE	Discharge capacitor
DISP	Display message to operator
JMPx/LABEL	Unconditional or conditional jumps to labels based on measurements or keyboard input.
EXEC	Call user-written test step (.EXE or .COM file)
MEMx	Numeric or string variable manipulation
CALL	Call a subroutine
RUNT	Execute another test file and return
WAITK	Wait for operator to press a specified key
FIXID	Test fixture ID to verify correct kit is installed
FIXCH	Test fixture connections for proper contact
WIRE	Test for connection or request that the operator make a cable connection
SWITCH JUMPER	Test for proper setting or instruct the operator to make the UUT setting
POT	Test potentiometer setting. Provides a graphical meter display if an adjustment is necessary

System Mechanical Format

The Analyst *mc* consists of a compact, integrated chassis which includes the fixture press, system electronics, and system computer resources.

The fixture kit is inexpensive to minimize your recurring costs. It includes storage handles to make storage and moving easy. Installing the fixture kit simply involves clicking the two parts into place. The bottom assembly includes a fiberglass probe plate, fixture interface, and pan covering the wiring. The top assembly is a clear polycarbonate plate that is used with pressure rods to press the UUT down onto the guide pins. It can be machined and milled with openings for top access to the UUT to allow for switch settings and adjustments. The front and sides of the UUT are accessible during test time for access to adjustments.

When the operator moves the actuation lever, the top plate moves forward and down to engage the UUT. The top plate movement is very linear at time of probe actuation so there is minimal side stress on the probes, even when doing top and bottom probing on the UUT.

The actuation lever can be moved to the right or left side of the system depending on operator preference.

The Analyst *mc* chassis supports the system monitor. During testing, the system can be controlled by the front panel switches that are equivalent to F1 through F7 and ESC. The front panel includes large bright LEDs that indicate power, and pass/fail/busy status of the system.

When programming, the user can install the keyboard and mouse by plugging them into the system.

For access to the system electronics, the top and back hinge open. To make repair easy, the electronics include a modular controller card and plug-in test point electronics modules.

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	0.2V	3% F.S.
190Ω *	10mA	2V	2% F.S.
1.9KΩ *	1mA	2V	2% F.S.
19KΩ *	0.1mA	2V	2% F.S.
190KΩ *	10µA	2V	2% F.S.
1.9MΩ *	1µA	2V	3% F.S.
19MΩ	0.1µA	2V	6% 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	3.8VDC or 2VAC RMS	2% Value+0.5Ω
10KΩ to 100KΩ	3.8VDC or 2VAC RMS	3% Value
100KΩ to 1MΩ	3.8VDC or 2VAC RMS	5% Value
1MΩ to 10MΩ	3.8VDC 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	5%+0.5µH	5%+0.5µH	15%+2µH	–
10µH - 100µH	5%+2µH	5%+2µH	15%+4µH	–
100µH - 1mH	5%	5%	5%	11%
1mH - 10mH	11%	5%	5%	5%
10mH - 100mH	–	15%	5%	5%
100mH - 1H	–	–	15%	5%
1H - 10H	–	–	–	15%
10H - 100H	–	–	–	15%
100H - 1000H	–	–	–	25%

Specifications assume residual inductance is offset. Specifications apply to 2V source. 0.2 and .02V sources are also available. For 0.2V, multiply accuracy by 3. For .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	5%[1]	5%[1]	5%[1]	–	–	–
100pF - 1000pF	5%[2]	5%[2]	5%[2]	15%[2]	–	–
1000pF - 0.01µF	15%	5%	5%	5%	–	–
0.01µF - 0.1µF	–	5%	5%	5%	–	–
0.1µF - 1µF	–	15%	5%	5%	–	–
1µF - 10µF	–	–	5%	5%	–	–
10µF - 100µF	–	–	15%	5%	5%	–
100µF - 1000µF	–	–	–	15%	15%	5%
1000µF - 20000µF	–	–	–	15%	25%	15%

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 under 100pF can be difficult to measure in many circuits.

Specifications assume residual capacitance is offset and apply to 2V source. 0.2V and .02V sources are also available. For 0.2V, multiply accuracy by 3. For .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.

Guarding

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

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.

Voltage Measurement

The System can measure DC voltages, such as on-board batteries.

DC Voltage Measurement

Measurement Range	Accuracy
± 0.2V	6mV
± 2V	60mV
± 10V	250mV

Ranges are bipolar. Stimulus may float up to 8V from ground.

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 20V can be performed using up to 10mA of applied current.

Diode Test Type

Accuracy

Range	Source Current		
	10mA	1mA	0.1mA
2V	±60mV	±60mV	±60mV
10V*	±250mV	±250mV	±250mV

* Typical constant current to 7V compliance

Zener Test Type

Range	Source Current	Accuracy
20V	10mA	±350mV

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	2 seconds

(Test time depends on UUT circuit topology)

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

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

Opto-isolator Testing

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

Test System

Base Size	16"W x 21"D x 13"H
Overall Size	20"W x 24"D x 26"H (with monitor)
Mechanical Fixture Press	Single-action up, single-action down Fixture-engaged switch for auto-start
Actuation Arm Movement	180 degrees
Actuation Arm Force	15 lbs. max downward pressure with 400 probe loading
Top Linearity	Within .004" after probe contact (top or top and bottom probing)
AC Power	115/230VAC, 50/60Hz, 8A maximum
Outlets Required	2 for the test system and monitor, 3 with the printer option
Operating Environment	0° C to +35° C 0 to 80% RH (without condensation)
Fixture Travel	4.8" (top pressure plate moves down)
Top Height (disengaged)	Moves up 4.8"
Top Depth (disengaged)	Moves back 2.2"
Fixture Interface	Two 200-Point Receiver Wiring Blocks
Front Panel	Power, Pass, Fail, and Busy LEDs Indicators
Front Panel Keypad	Test (F1), ReTest (F2), F3-F7, and Escape
Weight	Approximately 90 lbs. total; 65 lbs. without monitor and fixture kit (shipping wt. approximately 100 lbs.)

KIT600-QC Fixture Kit

Probe Area	8.5"D x 11.75"W
UUT Height	1.15" (UUT PCB to top pressure plate)
Closed Height	1.525" (probe plate to top pressure plate)
Inside Depth	2.94" (inside the bottom of fixture kit)
Probe Plate	0.375" G-10 (FR-4) fiberglass material
Top Plate	0.50" clear polycarbonate
Probe Count	Up to 600 (400 maximum on Analyst mc)
Weight (Kit)	Approximately 10 lbs. (shipping wt. approximately 15 lbs.)

CheckSum Analyst *mc* MDA Test System

Test System Configuration

The Analyst *mc* is complete and ready to use once you have a custom test fixture and test program created for your UUT. The test system includes:

- Chassis with 400 test points
- CD-ROM, hard-disk drive, 1.44MB floppy-disk drive
- Keyboard, Mouse
- MS-Windows Software
- Visual MDA™ Test System Software
- Integrated Fixture Press
- SVGA Monitor (15", 13.8" viewable)
- Power cord
- Probe set
- Shorting Fixture
- Instruction Manual

Test System Accessories

KIT600-QC	Fixture Kit
SPKIT-1	Analyst *mc* System Spares Kit
TRAIN-1	Factory training on use and maintenance of Analyst *mc* (1 ½ days)
CM-3-KIT600	Calibration Fixture Kit with Shorting Fixtures
T-120-2P	40 Column Dot Matrix Industrial Parallel Strip Printer with Cable
T-120-2-R	Replacement Ribbon for T-120-2P
T-120-2-50P	Case of 50 rolls of paper for T-120-2P

SPKIT-1 Analyst *mc* System Spares Kit

The SPKIT-1 spares kit includes:

- Bushing set for the system mechanical mechanism
- Two Struts
- One Test-Point Electronics Module
- One Fixture-Down Switch
- Ten Spare Interface Probes

KIT600-QC Fixture Kit

The KIT600-QC fixture kit includes:

- Probe-plate with bottom pan
- 2 shipping/storage handles
- Clear polycarbonate top plate
- 10 MA-ROD pressure rods

Fixture Kit Accessories

FIX-200P-WB	200 Point Wiring Block Fixture Kit
MA-ROD	Pressure Rod (1.150")
MA-ROD-T	Tapered Pressure Rod (1.150")

Contact the CheckSum fixture group for more information and competitive custom fixturing and test programming quotes.

Terms and Conditions

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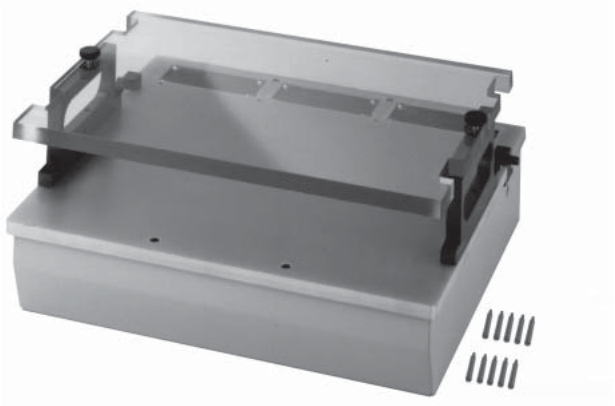
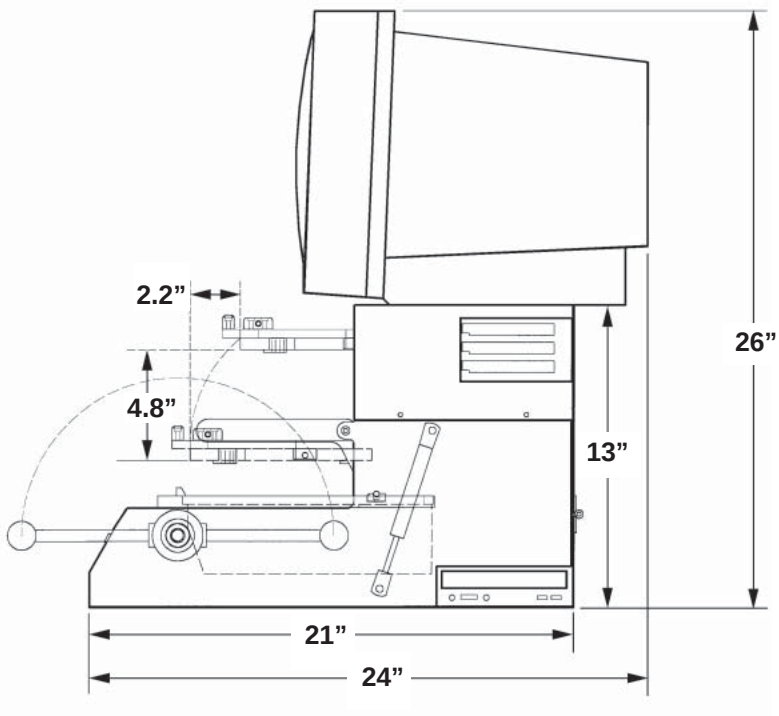
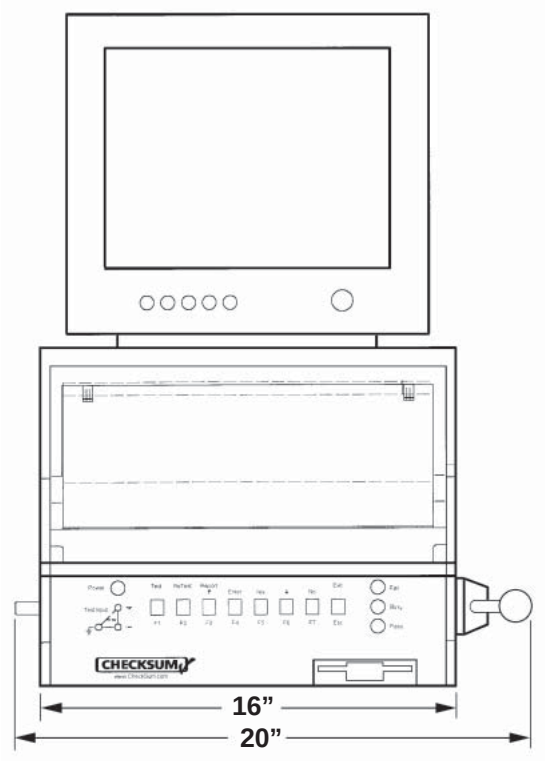



2.2”
4.8”
26”
13”
21”
24”


CHECKSUM
16”
20”

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Specifications Subject to Change (9/2000)