TR-8 MDA Test Systems

Product Features

- MDA Power-off In-Circuit Test
- Bed-of-Nails Testing
- Quick-Change Fixturing
- 8000 Test Point Capability
- Top and Bottom Probing Fixture Systems
- Powerful Visual MDA™ Software

Applications

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

The CheckSum TR-8 MDA Test Systems are 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.

CheckSum TR-8 test systems can be configured from 200 test points to 8000 test points. These test systems can be configured with numerous fixture systems ranging in capacity up to several thousand test points.

Console TR-8 MDA Test System

Typical Bench Top TR-8 MDA Test System

The Model TR-8 MDA test systems can be expanded with the CheckSum Model FUNC-2 functional module for power-up functional testing. Most of the standard configured TR-8 test systems include the power module for additional guard current and relay actuation testing. To verify the accuracy of the TR-8 module, the CM-3 calibration verification module is a recommended option to a TR-8 test system. If a printed test report is needed, an optional CheckSum printer is available. The TR-8 MDA tester allows you to detect SMT opens and capacitor polarity using the Agilent TestJet technology option. Boundary-scan test or in-system programming (ISP) is available for UUTs that have been designed to take advantage of this technology.

The Windows version of the TR-8 MDA system software, **Visual MDA™ for Windows** includes a test executive with both an operator and programmer interface. This test system software integrates measurement setup, configuration, test development, and data analysis. This test system software is complete and includes:

- Real-time Pareto graphics track production yields and identifies problem components.
- Graphical X-Bar/Sigma Report identifies process or component variation trends.
- Panelization Wizard makes test program generation

easy for assemblies with multiple boards attached to a single panel. The test window displays a virtual PCB panel that shows which of the panelized boards passed and failed.

- Login capabilities and password protection allow access to be controlled to specific features of the test station.
- Interactive measurement windows allow test generation in a few hours.

Measurement Capabilities

Even though CheckSum MDA systems are truly low in cost compared with alternatives, they provide extremely sophisticated measurement capabilities. You can choose from several basic techniques to achieve the best in-circuit measurement results. Measurements use DC current or AC/DC voltage as measurement stimulus.

Resistance, Capacitance and Inductance Measurements

- Current-based measurements apply a DC constant-current through the component being measured, then measure the resultant voltage drop. For current-based capacitance measurements, the system measures the characteristics of the developed voltage rise over time to determine the capacitance value.
- DC voltage-based measurements apply a voltage to the component being measured, then measure the actual voltage across the component and the current that passes through it.
- When AC voltage-based complex-impedance measurements are made, the system applies the signal, then measures the in-phase and quadrature-phase voltage and current. From these, the capacitive, inductive and resistive components of the measurement are determined. By choosing from alternative frequencies, the impedance of the measured component can be optimized compared to parallel impedances for best measurement results.

In some cases, capacitor polarity can be tested by applying current-limited DC to the capacitor and measuring the voltage across the capacitor. A lower voltage is developed if the capacitor is installed incorrectly.

To eliminate the effects of path resistance internal to the tester and in the fixture wiring, measurement points can be externally sensed, providing 4-wire Kelvin measurement capability at the UUT rather than internal to the tester. This helps increase the accuracy of low impedance measurements.

To prevent semiconductors from turning on during the measurement, you can choose a 20 or 200 mV full range stimulus in place of the standard 2 V stimulus. AC measurements can be biased to prevent interference from parallel diodes in the measurement path.

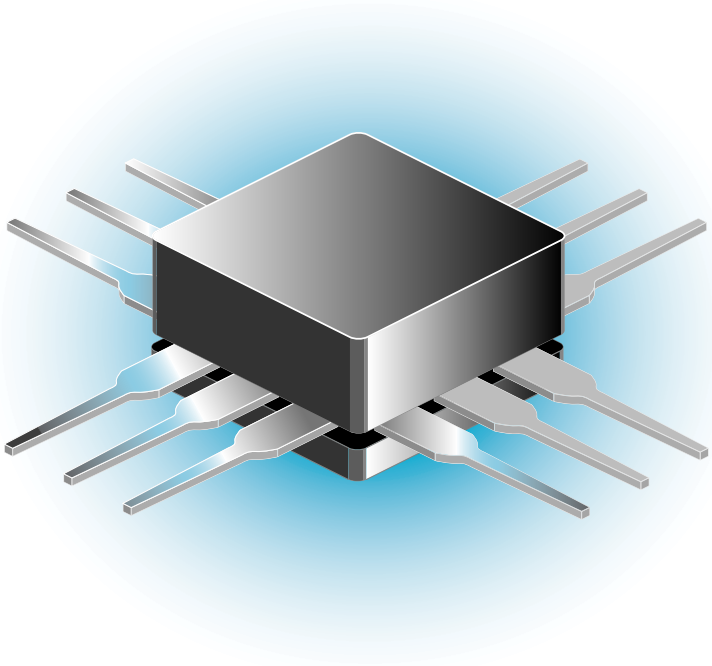
Guarding

In-circuit measurements often contain parallel impedances that can cause measurements to deviate from component nominal values.

Guarding provides the capability to minimize the effects of parallel impedance paths. Guarding uses special sense and drive circuitry to source or sink current into other UUT circuit nodes to eliminate current flow through these paths.

CheckSum MDA systems allow you to specify multiple guard points during a measurement. Guard points can be externally sensed to provide additional guarding accuracy when low impedance paths exist. With CheckSum MDA systems, any test point can be used as a guard point. No special wiring is required.

Unlike other MDA systems, CheckSum uses separate guard drivers for each of its guard points. This additional sophistication can provide the proper guard voltage at each guard point, regardless of connection impedance differences.



Even without guarding, MDA systems can often directly measure components of different types connected in parallel, such as a capacitor and a resistor, with use of complex-impedance measurements.

Transistor and FET Testing

Three-terminal devices such as transistors and FETs are tested by measuring between the current-carrying terminals while biasing the control terminal. FETs are biased with voltage, while transistors are biased with current.

Diode Testing

Diodes, LEDs, zener diodes and transistor junctions are tested by applying a constant-current, then measuring the voltage dropped across the device.

IC Orientation and Presence Testing

IC presence and orientation is verified by checking the semiconductor junction voltage of the protection diodes typically present between IC pins and the UUT power supplies.

Opens and Shorts Detection

Since most faults that occur during manufacturing are shorts, MDAs provide the ability to perform continuity testing for opens and shorts. The systems automatically learn the continuity map of a known-good UUT, then test against this map for other UUTs. Selected open/short measurements can be ignored to prevent testing of components near the continuity threshold or to provide better diagnostics with separate measurements.

Using Agilent TestJet technology, CheckSum MDA systems can find open connections to surface-mount technology (SMT) devices such as ICs and connectors.

Relay Testing

UUT relay coils can be controlled for testing contacts in both the normal and actuated positions.

Transformer Testing

Transformer coil presence can be tested with resistance and/or inductance measurements. CheckSum MDA systems can also test the polarity of transformer connections to ensure that they are correct. Since transformers are often hand terminated, this will find faults not detected by normal coil resistance testing.

Digital I/O

Systems may include a few bits of digital I/O (expandable) that can be used for sensor input, control output, or limited digital testing.

Agilent TestJet technology

A common fault in surface mount technology manufacturing is open connections. On components with bussed connections or high impedance pins, these faults cannot be detected by normal analog in-circuit measurements. CheckSum MDAs allow you to detect these faults using award-winning Agilent TestJet technology. A flat probe is built into the fixture over each component body to be tested. The system measures from this top probe to each signal pin on the SMT device. By measuring precise capacitance values, the system can detect open connections. This technology works for most SMT ICs and connectors.

Capacitance polarity detection is available with Agilent TestJet technology-equipped systems. This capability makes use of special top probes and is applicable to aluminum and tantalum polarized capacitors in axial and SMT packages up to about 200uF.

Boundary-Scan

Boundary-scan testing is available to test UUTs that have been designed to take advantage of this technology. Boundary-scan utilizes a 4-wire serial bus that can control and read back states within the UUT circuitry. This provides the ability to test complex circuitry (or some individual ICs) without full nodal physical access. CheckSum provides for boundary-scan test execution within the system software to support combined MDA and boundary-scan testing.

Software Capabilities

CheckSum MDA systems are quick and easy to program. The interactive, spreadsheet-like programming environment allows you to program the system either on-line or with a remote PC. Assemblies can typically be programmed and debugged in less than a day.

Test Programming

Systems can be programmed by manual entry or automatic conversion of computer-aided-design (CAD) data.

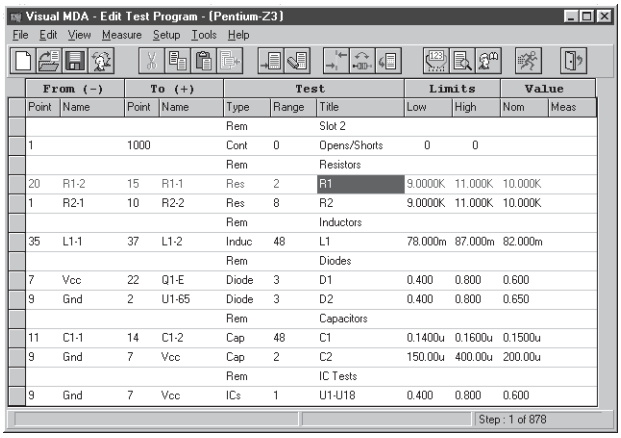
When CAD data is available, you can read the net list and component data to generate a wiring list for the fixture and to generate a basic test program. This process can significantly reduce the amount of time and errors that can result from manual entry. The system software supports translation of data from OrCAD, P-Cad, Mentor, Cadence, Viewlogic, Tango, Veribest, ComputerVision, Pads2000, Schema, FABMaster,

TR-8 MDA Test Systems

Scicards, and Racal-Redac systems. It can also convert data from HP-BCF or CheckSum-ASCII format.

If desired, test fixtures can be random-wired. You can assign meaningful test point names by touching each point with a probe, then typing in a descriptive name. Alternatively, you can let the system automatically assign alphanumeric sequential names as you touch each point.

Once the pins are assigned, the system can self-learn the assembly's connection map for opens/shorts testing, a map of the diodes present in the assembly for automatic testing of IC presence and orientation, and SMT connection maps using Agilent TestJet technology. If needed, you can edit this self-learned information to assign specific data or don't-cares.



Program Entry Screen

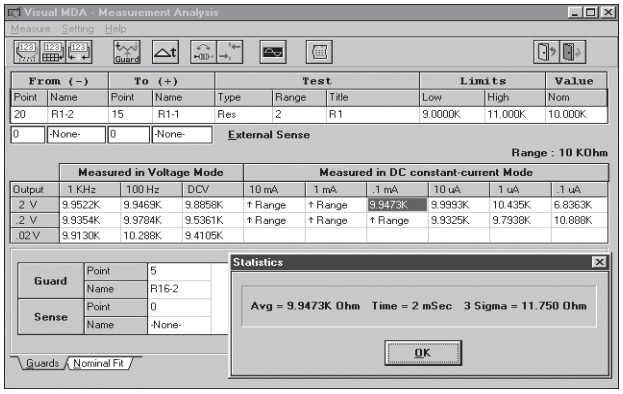
For manual entry of each component on your assembly, you enter the two test point names or numbers, the type of test (e.g., Res for resistance test), the component name (e.g., R1), and the nominal value (e.g., 10K). From this information the system can automatically take a measurement, pick an initial measurement technique

Software Functions Provided

- Auto-learn opens/shorts from known-good sample
- Auto-learn ICs presence/orientation from known-good sample
- Automatic support for panelized PCBs
- Automatic selection of test method and guarding
- Enter or edit UUT specification data
- Enter or output UUT data in ASCII file
- On-line help
- Generate initial test program and assign test points from CAD data such as OrCAD, Mentor, Racal-Redac, P-Cad, HP-BCF, Pads2000, ComputerVision, Tango, Veribest, Cadence, VIEWlogic, Fabmaster, Scicards
- Specify skipped steps for debug or configuration
- Offset and scaling of analog measurements
- Fixture-check for connection integrity
- Auto-learn resistance/capacitance offsets
- Self-test each I/O pin and control circuitry
- Probe for test point identification with autonaming
- Execute steps interactively during programming with automatic tolerance and range assignment
- Assign special operator instructions screen
- Optional foot switch facilities
- Optional operator keypad
- Assign 8-character pin names
- Assign 12-character test names
- Print test results (all or fail only)
- Print test report for batch (yield report)
- Print specification data for UUT
- Print fixture wiring report with both sequential point number and alphabetic name sort
- Configure report destination and formatting options
- Enter up to 1000 test steps per test program
- Test programs can be nested, providing up to 17,000 test steps per UUT with full logging capability (more without full logging)
- Print SPC Reports (Production, Pareto & X-bar/Sigma Control Reports)
- 40-column printer support for results output
- LAN support

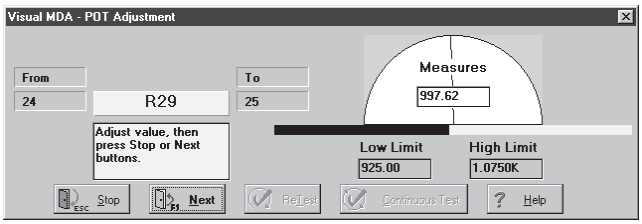
and range, and assign test tolerances. Alternatively, you can manually enter this information or override the system-assigned values.

For problem measurements, the software can choose a recommended measurement technique for you or it can display a set of measurements taken with various techniques in table format so that you can quickly choose the best method and interactively assign guards if necessary. While defining tests, the system can display measurement statistics such as speed, average measured value and standard deviation of each measurement to help you choose the best technique.



Measurement Analysis Display (10KΩ resistor)

CheckSum MDAs have the flexibility to provide interactive operator adjustments, display messages and perform conditional testing based on outcome of operator entry or measurement results. For special testing needs you can write programs in various languages (resulting in a .COM or .EXE file) and execute them from within the standard test sequence.



Typical Test Adjustment Display

The systems also support panelized PCBs. When you are testing multiple similar assemblies, the systems allow you to write the program once and automatically step and repeat it for the other assemblies in the panel. At test time, the operator can skip assemblies in the panel. Test results are appropriately separated by assembly.

```
                    Assembly Test Report

 Testing Facility:  SigmaRho Mfg. Inc. - Dept 2S34

 Assembly ID:       PN 3421-E Rev A

 Failures:          0

 Report Date:       Mar 15, 2000
       Time:        07:12

 Test System:       CheckSum Model TR-8/6 Test System

================================================================================

  --From--    ---To---    ----------Test----------    --Limits--    --Meas--
Port  Name  Port  Name  Type  Range     Title        Low     High

                        Cont        Opens/Shorts      0        0        0
128   C38-1  98    +5V   Cap     3    C38 132933 4.5000u 8.0000u 5.0961uF
 18   U101-3 22   C13-2  Cap     5    C13 120902 0.3000u 0.7000u 0.3988uF
  6   C21-1  13    GND   Cap     3    C21 120899 3.0000u 7.0000u 4.5901uF
 16   +12V   13    GND   Cap     3    C11/37/33  31.500u 47.500u 33.987uF
141   +18V   13    GND   Cap     2    C30 132933 175.00u 260.00u 204.50uF
 14   AnaGnd 13    GND   Res     2    R18 115651 800.00  1.2000K 951.80
102   L1-1   31   L1-2 Induc    17    L1  345232 35.000m 40.000m 37.200mH
 13    GND   51   R19-L  Res     4    R19 115674 40.000K 110.00K 49.712K
 12   R2-L   13    GND   Res     3     R2 125113 1.8000K 2.4000K 1.9476K
 97   D1-1   106  D1-2 Diode     2    D27 325642 .40000  .80000  0.6120
 16   +12V   55   R27-L  Res     4    R27 125750 15.000K 50.000K 31.066K
 13    GND   124   SW1   Res     2     Switch2 500.00  900.00  723.10
136   R67-2  98    +5V   Res     4    R67 121322 7.0000K 13.000K 9.8740K
```

Typical Test Report

Once the test program is completed, you can print reports of the test steps and fixture wiring, then save the program to the system disk. The program can easily be edited in the event of changes to the assembly, and can be password-protected to prevent inadvertent changes.

Testing

At test time, the system can execute the program in its entirety or be configured to single-step or to halt in the event of failures. In the event of a halt, the test can be continued, aborted or repeated.

Once a test is completed, the operator can print full or failure-only reports for the assembly or obtain a batch yield report. Reports can also be automatically generated and directed to a choice of printers or to the system disk.

The controller's monitor, keyboard, an external keypad, and a foot switch can be used for operator control of the system. The monitor displays status and prompts to the operator. The keyboard can control all system operations (unless password protected). The keypad can be located near the fixture where the operator can see UUT pass/fail status via lights and control the system for common testing operations. The foot switch controls normal repetitive operations such as beginning each test.

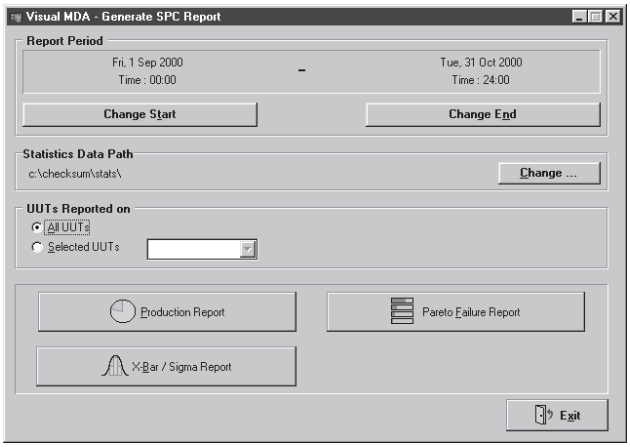
Partial List of TR-8 Test Step Types

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)
TESTJET	Open SMT leads test (one component/ step)
XFMR	Check Transformer Polarity
BETA	FET/Transistor Operation Test
DIGI/DIGO	Digital input and output
PORTI/O	PC port input and output
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
FIXCT	Apply/remove vacuum/pneumatic pressure from test fixture
FIXCH	Test fixture connections for proper contact
SWITCH JUMPER	Test for proper setting or instruct the operator to make the UUT setting
POT	Test potentiometer setting. Provide graphical meter display if an adjustment is necessary.

Statistical Process Control (SPC) Reporting

Systems allow you to log information from the tests to the system disk for statistical process control (SPC). You can either load the raw data into a spreadsheet for your own custom analysis or choose one of the standard SPC reports.

Reports can be confined to a particular time frame or assembly type:



SPC Report Selection Screen

1. The **Production Report** tells how many assemblies have been tested (by type), how many passed and failed, how many errors were found and the consequent yield.

2. The **Pareto Failure Report** lists the failures sorted by frequency of occurrence to help you isolate the most common problems.

3. The **X-Bar / Sigma Report** includes the mean (average) value of each measurement, the standard deviation, the test limits, the 3-sigma values, and Cpk/ Cp. This report helps determine process problems and can be useful for assigning proper upper/lower test limits for each UUT.

Functional Test Compatibility

The Model TR-8 MDA test systems can be expanded with the CheckSum Model FUNC-2 Functional Test module for power-up functional testing. The MDA test points can be used for analog stimulus and measurement of up to ±12V from controller ground. Higher voltage signals can be routed through FUNC-2 relay test points or disconnected during functional test using the CheckSum FIX-50P-SWO 50-point Switch-Over Module.

Many common functional test operations can be entirely performed with the fully integrated MDA/Functional test system. For special test requirements, IEEE-488 external instrumentation can be controlled with use of the CheckSum Model GPIB interface.

For detailed information about functional test, see the *Functional Test System* section of this catalog.

TR-8 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	10 mA	0.2 V	2% F.S.
190Ω *	10 mA	2 V	1% F.S.
1.9KΩ *	1 mA	2 V	1% F.S.
19KΩ *	0.1 mA	2 V	1% F.S.
190KΩ *	10 µA	2 V	1% F.S.
1.9MΩ *	1 µA	2 V	2% F.S.
19MΩ	0.1 µA	2 V	5% F.S.

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

Measurement using AC/DC Voltage Stimulus

Range	Source Voltage, Typical	Accuracy
0 to 10KΩ	3.8V DC or 2V AC RMS	1% Value+0.5Ω
10K to 100KΩ	3.8V DC or 2V AC RMS	2% Value
100K to 1MΩ	3.8V DC or 2V AC RMS	4% Value
1M to 10MΩ	3.8V DC or 2V AC 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 1 MΩ). For internally sensed measurements, add 2Ω to accuracy. Available AC stimulus frequencies 100Hz and 1KHz. Technique is fully auto-ranging. Source current is less than 10mA.

Inductance Measurement

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

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

Specifications assume residual inductance is offset. Specifications apply to 2V source. 0.2 and .02V sources are also available. For .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
1-100pF	4%[1]	4%[1]	4%[1]	—	—	—
100pF - 1000pF	4%[2]	4%[2]	4%[2]	10%[2]	—	—
1000pF - .01µF	10%	4%	4%	4%	—	—
.01µF - 0.1µF	—	4%	4%	4%	—	—
0.1µF - 1µF	—	10%	4%	4%	—	—
1µF - 10µF	—	—	4%	4%	—	—
10µF - 100µF	—	—	10%	4%	4%	—
100µF - 1000µF	—	—	—	10%	10%	4%
1000µF - 20000µF	—	—	—	10%	20%	10%

Notes:

1. ± 5pF
2. ± 10pF
3. While small isolated capacitances (pF region) can effectively be tested by the system, often times in-circuit influences such as parallel impedances in ICs degrade measurements.

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 Model TR-8 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. Since each measurement or guard point can be externally sensed, up to sixteen test points can be active in a single measurement.

Guarding uses a separate guard amplifier for each guard point to provide extremely precise guarding. If the optional Model TR-8-PWR Module is specified, the system can provide additional guarding current. This current, available through specially wired points, can allow measurement of components with extremely low parallel impedance. 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.

Model TR-8 MDA Specifications

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-8):	20mA
Maximum Total Guard Current (TR-8-PWR):	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 TR-8-PWR points.

Voltage Measurement

The Model TR-8 can measure DC voltages, such as on-board batteries or for UUT power-on testing.

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

Ranges are bipolar.

Stimulus may float up to 6V 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 18V using 10 mA of current are available, extended up to 100 mA of applied current when the Model TR-8-PWR option is used (see Power Source Capability section).

Diode Test Type

Accuracy

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

Zener Test Type

Accuracy

Range	10 mA Source Current
18V	± 300 mV

Opens/Shorts Measurement

Continuity measurement is performed to find the most common manufacturing fault, shorts. The system self-learns a known-good UUT, then tests against this map. The 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	3 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.

Agilent TestJet technology

A common fault in surface mount technology manufacturing is open connections. On components with bussed connections or high impedance pins, these faults may not be detected by normal analog in-circuit measurements.

The optional Model SMT-2 provides the capability to detect these faults using Agilent TestJet technology. A flat probe is built into the fixture over each component to be tested. The system measures from this top probe to each signal pin on the SMT device.

Measuring minute capacitance values, the system can detect open connections. This measurement method may also be used to verify connector integrity. Since the probes are active, this technique is very repeatable and usable without degradation from fixture wiring capacitance and cross-talk.

Because the top-probe multiplexing is built into the test system, fixture-resident multiplexing is unnecessary. This reduces the recurring cost of fixturing. A good pin is typically 20 fF to 200 fF, depending on the packaging 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, expandable up to 8 modules. Each module contains a relay driver for low impedance grounding in the fixture. Relay drive is 100mA at 12V.

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

Model TR-8 MDA Specifications

Capacitance Polarity

A system with the Model SMT-2 option can be used to measure polarity of capacitors. The SMT-2 option, which makes use of special component-sensing probes, can be used for aluminum and tantalum polarized capacitors in axial and SMT packages, up to approximately 200µF. Radial aluminum electrolytics generally cannot be tested using this technology. The SMT-2 can test up to 24 capacitors on a UUT, with expansion (by additional SMT-2-EXP modules) up to 192 capacitors.

In special cases, polarity testing can be done by applying a constant current, then measuring the voltage. The developed voltage may be lower if the polarized capacitor is installed with incorrect polarity. The system can apply between 0.1µA and 100 mA (with the TR-8-PWR option) for these tests. Suitability depends on the UUT circuit topology and nature of the capacitors being measured.

3-Terminal Semiconductor Measurement

Three terminal devices can be measured between the power terminals (e.g., source and drain) 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 Source: Current -1mA to +1mA
or Voltage -10V to +10V

Boundary-Scan

The Model TR-8 can be expanded to include integrated boundary-scan testing of UUTs that have ICs designed to take advantage of this technology. You or your boundary-scan provider can generate the specific boundary-scan test sequences to control your UUT. The execution and test results are integrated in the CheckSum TR-8 test and operating environment. CheckSum provides boundary-scan hardware and execution driver software environment for boundary-scan implementations.

Digital I/O Capabilities

The Model TR-8 includes eight individually bi-directional digital bits, each of which can be tri-stated or configured for input or output. Each bit can sink 24 mA or source 2.6 mA, and uses a 10 KΩ pull-up resistor for TTL/CMOS compatibility.

Th Model DIG-1 or Model G-80 can provide additional digital I/O points. The optional Model DIG-1 Digital I/O Module provides 48 digital bits per module, 8 modules maximum per system. The optional Model G-80 Digital I/O Module provides 96 digital bits per module, 1 module maximum per system.

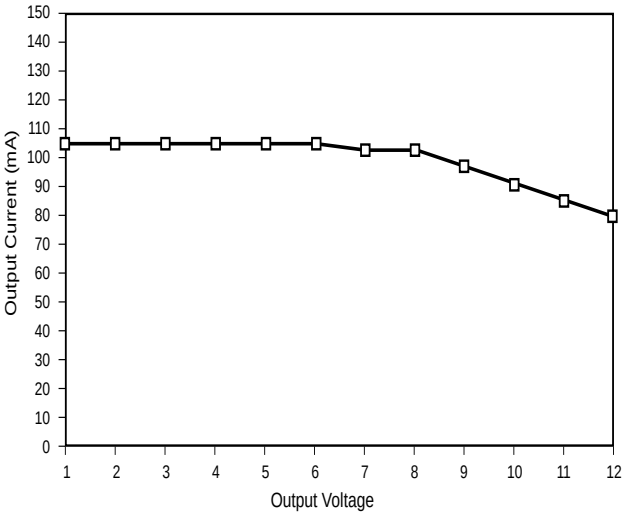
Power Source Capability

The Model TR-8-PWR Module option can be used to provide higher current outputs from the system. These higher current outputs can be used to actuate UUT relays, power-up low power UUTs, provide additional guard current, or apply stimulus for power-up testing. The module has dual voltage-programmable high current outputs that can be set from +12V to -12V (up to 24V differential). For switching these outputs to the UUT, 16 relay test point outputs are provided. Voltage and current output can be monitored. Fixed 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.

TR-8-PWR Programmable Power Supplies

No. of Channels:	2
No. of Test Points:	16
Programmable Voltage:	-12V to +12V, in 6mV increments
Maximum Total Current:	see the plot below
Current Measurement:	±10%
Voltage Measurement:	±(10%+300mV) when in current limit

Power Module Source



Model TR-8 MDA Specifications

TR-8-PWR Fixed Power Supplies:

+12V at 1 A, +5V at 1 A, -12V at 0.1A
Switched for rear panel output only

TR-8-PWR Undedicated Relays:

4 Independent relays each SPDT (Form C), 1A at 24V

Operator's Keypad

The Model TR-8-KEYPAD allows the operator to use the system without a standard keyboard. The keypad provides three system status LEDs (green for pass, red for fail, amber for busy). The keypad has eight keys for operator control. F1 through F7 keys are used for most operations such as next-test or retest, and the ESCape key aborts most operations. The keypad is connected directly to the TR-8 System Module back panel. (See *Test Accessories* section).

General Notes

To obtain stated accuracies, low impedance measurements (less than about 100Ω) may require external sensing to compensate for typical 5-10 Ω 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 100 Ω.

Operating Environment

The test system operating temperature range is 0° C to +35° C with 0 to 80% RH (without condensation).