

# Model TR-8 MDA System

## 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	.2 V	2% F.S.
190Ω *	10 mA	2 V	1% F.S.
1.9KΩ *	1 mA	2 V	1% F.S.
19KΩ *	.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	.1 μA	2 V	5% F.S.

\*.2V ranges are also available. For .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+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)

.2V & .02V sources are also available. For .2V, multiply accuracy by 3. For .02V, multiply accuracy by 10 (not specified above 1 MΩ).

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
0μH - 10μH	4%+.5μH	4%+.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 <10mA. Measurements <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 2 pF - 20,000 μF<sup>3</sup>.

Range	Accuracy					
	100KHz	10KHz	1KHz	100Hz	1mA	10mA
0-100pF	4% <sup>1</sup>	4% <sup>1</sup>	4% <sup>1</sup>	—	—	—
100pF - 1000pF	4% <sup>2</sup>	4% <sup>2</sup>	4% <sup>2</sup>	10% <sup>2</sup>	—	—
1000pF - .01μF	10%	4%	4%	4%	—	—
.01μF - .1μF	—	4%	4%	4%	—	—
.1μF - 1μF	—	10%	4%	4%	—	—
1μF - 10μF	—	—	4%	4%	—	—
10μF - 100μF	—	—	10%	4%	4%	—
100μF - 1000μF	—	—	—	10%	10%	4%
1000μF - 20000μF	—	—	—	10%	20%	10%

#### Notes:

1. ± 5pF

2. ± 10pF

3. While small isolated capacitances (pF region) can effectively be tested by the system, often times in-circuit influences such as parallel impedances in IC's degrade measurements.

Specifications assume residual capacitance is offset and apply to 2V source. 0.2V 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 <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 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-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		
	10mA	1mA	.1mA
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 2 - 50 KΩ.

Typical Test Time for 600 Test Points: 4 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.

## HP 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 TR-8-SMT provides the capability to detect these faults using HP 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. 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

## MDA TEST SYSTEM SPECIFICATIONS



# Model TR-8 MDA System

## Fixed Power Supplies:

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

## 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  $100\Omega$ ) may require external sensing to compensate for typical 5-10  $\Omega$  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  $100\Omega$ .

## MDA TEST SYSTEM SPECIFICATIONS