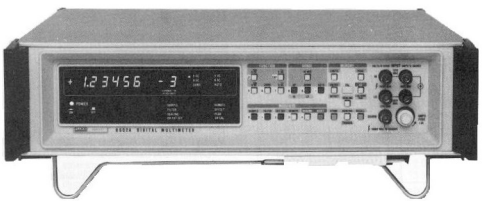
8502A

RS-232



(NSN 6625-01-126-3154) **8502A**

8502A Digital Multimeter

- 6 ppm dc accuracy
- 6½-digit resolution
- 500 readings per second system speed
- Modular construction for configurability
- Interface options: IEEE-488, RS-232-C, or Parallel
- Measurement options:
  AC volts, true-rms or averaging
  Resistance
  Current
- Up to 212% overrange

Circuit Card Modules

The basic 8502A measures dc voltage or the ratio of two dc voltages. With optional plug-in circuit card modules it will also measure resistance, ac or dc current, ac voltage, or the ratio of such a quantity to an external dc voltage.

One option is for resistance, one is for current, and two are for ac voltage — either true-rms for sinusoidal or non-sinusoidal waveforms, or average-sensing for sinewaves. The current-measuring option is good for both dc and ac current but one of the ac voltage measurements options must also be installed. All the measurement capabilities may be included in one instrument if you wish, except that only the true-rms or the average-sensing measurement module can be included at one time.

Peaks, Valleys, Limits, Calculations

The 8502A may be operated to store the highest and the lowest values in a series of measurements for determining deviations, either directly or as a percentage. Or, where measurements are for testing whether certain values are within acceptable limits, preset limits may be entered and stored for comparison. Then, measurements within limits are classified simply as PASS. Measurements that fall outside of limits are classified as either HI or LO, depending on whether they exceed a high limit or fall below a low limit. These classifications appear in the display whether it is operated remotely or operated from the front panel.

Measured values may be multiplied by a factor before a numerical value is displayed. Or, using offset, both multiplied and added (or subtracted) using the general formula: Y = mx+b.

Specifications

DC Volts

Range	Normal Full Scale	5½-Digit Resolution	Resistance
100 mV	312 mV	1 μV	>10,000 MΩ
1V	2.5V	10 μV	>10,000 MΩ
10V	20V	100 μV	>10,000 MΩ
100V	160V	1 mV	10 MΩ
1000V	1200V	10 mV	10 MΩ

Reading Rate (Bench Operation)
Fast: 7½ rdgs/s (60 Hz line); 6¼ rdgs/s (50 Hz line)
Slow: 1⅞ rdgs/s (60 Hz line); 1½ rdgs/s (50 Hz line)

Accuracy, 6½-Digit: ±(% of Rdg + Counts)

Range	24 Hours 23°C±1°C	90 Days 18°C to 28°C	1 Year 18°C to 28°C	Plus Temp Coefficient per °C[2]
100 mV[1]	0.002+4	0.003+5	0.005+8	0.0003+0.5
1V	0.001+6	0.002+8	0.004+9	0.0003+1
10V	0.0006 or 6*	0.001+8	0.002+9	0.0002+0.5
100V	0.001+6	0.002+8	0.004+9	0.0003+1
1000V	0.001+6	0.002+8	0.004+9	0.0003+0.5

* *Whichever is greater*
[1] *5½-digit accuracy on lowest range*
[2] *18°C to 0°C and 28°C to 50°C*

Normal Mode Noise Rejection

Filter	Programmed 4 Samples/rdg	50 Hz 1½ rdgs/s	60 Hz 1⅞ rdgs/s
50 Hz, Fast	60 dB	75 dB	—
50 Hz, Slow	85 dB	95 dB	—
60 Hz, Fast	60 dB	—	—
60 Hz, Slow	90 dB	—	100 dB

Common Mode Rejection: 100 dB at 60 Hz with 1 kΩ unbalance
Overload: ±1200V dc or 1400V pk ac, may be applied continuously to any range without permanent damage
Common Mode Noise Rejection: ≥120 db, dc to 60 Hz, with 100Ω unbalance

Ratio [External DC Reference]

Measurements of dc or ac voltage, dc or ac current, or resistance is divided by the measurement of an externally applied dc voltage and

displayed as a ratio. The measurements are made on two separate isolated sets of terminals but there should be no more than 20,000 ohms between the Sense LO terminal and either the HI or LO Reference input terminal. Input characteristics of the Sense terminals depend on the function selected. Characteristics of the rear panel Ext Ref input are as follows:

Input Resistance: >10,000 MΩ
Max Reference Voltage: 40V dc between Ext Ref HI and LO terminals, providing neither terminal is greater than ±20V relative to the Sense LO or Ohms Guard terminal
Minimum Ext Reference Voltage: Equal to the input (voltage, current, or resistance) divided by 10X the range selected or 100 μV, whichever is greater
Ratio reading: <10 times the value of the volts, amps, or ohms range selected
Normal Mode Noise Rejection: ≥100 dB for dc and 1X and 2X line frequency
Common Mode Noise Rejection: ≥75 dB for 1X and 2X line frequency
Overload: ±180V peak, 127V rms relative to Sense LO terminal or Ohms Guard terminal
Accuracy: For reference voltages of 20V to 40V, accuracy is ±(A + B + 10 ppm), where A = 10V dc-range accuracy and B = input voltage-, current-, or resistance-range accuracy. For reference voltages less than 20V, accuracy is ±(A + B + (200 ppm ÷ | Vref |))

Option Specifications

True-RMS AC Volts Option (-09A)

Range	Full Scale	5½-Digit Resolution	Impedance
1V	2.5V	10 μV	1 MΩ, <100 pF
10V	20V	100 μV	
100V	160V	1 mV	
1000V	1000V	10 mV	

Accuracy: ±(% of Rdg + % of Full Scale) (5½-Digits)

Frequency	90 Days, 18°C to 28°C		
	% of Input	+% FS (AC)	+% FS (AC + DC)
DC	0.1	—	0.03
10 Hz to 20 Hz	1.0	0.04	0.06
20 Hz to 50 Hz	0.5	0.012	0.03
50 Hz to 10 kHz	0.1	0.012	0.03
10 kHz to 30 kHz	0.2	0.04	0.06
30 kHz to 50 kHz	0.3	0.1	0.12
50 kHz to 100 kHz	1.0	0.3	0.3
100 kHz to 300 kHz	2.0	0.5	0.5
300 kHz to 1 MHz	3.3	1.8	1.8

1. *Filter must be used for full accuracy below 400 Hz. For 6½-digit display, multiply number of counts by 10*
2. *Volt-Hertz product not to exceed 2 x 10⁷; 300 kHz to 1 MHz, not to exceed 1 x 10⁷*
3. *For inputs above 500V, multiply accuracy by (2000V + V in) ÷ 2000V*

Common Mode Noise Rejection: ≥120 dB, dc to 60 Hz, with 100Ω unbalance
Crest Factor: >7 at full scale, increasing down scale by:

$7\sqrt{\text{V Range} \div \text{V Input}}$

Average-Sensing AC Volts Option (-01)

Range	Full Scale	5½-Digit Resolution	Impedance
1V	2.5V	10 μV	1 MΩ, <100 pF
10V	20V	100 μV	
100V	160V	1 mV	
1000V	1000V	10 mV	

Accuracy: ±(% of Rdg + Counts)*

Frequency	90 Days, 18°C to 28°C	
	1 mV to 500V**	Above 500V
30 Hz to 50 Hz	0.5 + 5	0.55 + 5
50 Hz to 10 kHz	0.05 + 5	0.1 + 5
10 kHz to 40 kHz	—	0.15 + 5
10 kHz to 50 kHz**	0.1 + 5	—
50 kHz to 100 kHz**	0.5 + 5	—

** Slow filter must be used below 400 Hz. For 6½-digit display, multiply number of counts by 10*
*** On 1-volt range add 7 counts above 10 kHz or 35 counts above 50 kHz*

Common Mode Noise Rejection: ≥120 dB, dc to 60 Hz, with 100Ω unbalance

Resistance Option (-02)

Range	Full Scale	5½-Digit Resolution	Current Through Unknown
10Ω	31.25Ω	100 μΩ	10 mA
100Ω	250Ω	1 mΩ	10 mA
1 kΩ	2 kΩ	10 mΩ	1.25 mA
10 kΩ	32 kΩ	100 mΩ	78 μA
100 kΩ	256 kΩ	1Ω	9.8 μA
1MΩ	4.096 MΩ	10Ω	4.9 μA
10 MΩ	32.768 MΩ	100Ω	0.61 μA
100 MΩ	262.144 MΩ	1 kΩ	76 nA

Accuracy: ±(% of Rdg + Counts) (5½-Digits)

Range	24 Hours 23°C ±1°C	90 Days 23°C ±1°C	1 Year 23°C ±1°C
10Ω	0.003 + 20	0.005 + 20	0.01 + 20
100Ω	0.002 + 2	0.003 + 2	0.006 + 2
1 kΩ	0.002 + 1	0.003 + 1	0.006 + 1
10 kΩ	0.002 + 1	0.003 + 1	0.006 + 1
100 kΩ	0.002 + 1	0.003 + 1	0.006 + 1
1 MΩ	0.002 + 1	0.003 + 1	0.006 + 1
10 MΩ	0.01 + 1	0.02 + 1	0.04 + 1
100 MΩ	0.03 + 1	0.05 + 1	0.1 + 1

Open Circuit Voltage

Range	Voltage	Configuration
10Ω to 100 kΩ	7V max	4-terminal
1 MΩ to 100 MΩ	25V max	2-terminal

Overload: ±400V dc to 60 Hz, or 560V peak above 60 Hz max, continuous on any range with no damage

Reading Rate (Bench Operation)

Filter	Approximate Rdgs Per Second			
	60 Hz		50 Hz	
	Fast	Slow	Fast	Slow
Fast	4	1-1/2	3-1/3	1-1/4
Slow	1-1/4	5/6	1	3/4

Current Option (-03)

Range	Full Scale	Resolution	Voltage Burden
100 μA	312 μA	1 nA	<100 mV
1 mA	2.5 mA	10 nA	<100 mA
10 mA	20 mA	100 nA	<200 mV
100 mA	160 mA	1 μA	<200 mV
1A	1.28A	10 μA	<500 mV

Overload: Fused at 1.5A, ±140V ac or peak ac to 60 Hz, 200V peak ac above 60 Hz with no damage
Settling and Digitizing Time: Same as dc volts

Direct Current Accuracy: ±(% of Input + Digits) (5½-Digits)

Ranges	24 Hours 23°C ±1°C	90 Days 18°C to 28°C	1 Year 18°C to 28°C
100 μA	0.02 + 10	0.03 + 10	0.05 + 10
1 mA	0.02 + 10	0.03 + 10	0.05 + 10
10 mA	0.02 + 10	0.03 + 10	0.05 + 10
100 mA	0.03 + 20	0.05 + 20	0.1 + 10
1A	0.03 + 20	0.05 + 20	0.1 + 20

Alternating Current Accuracy: ±(% of Rdg + Counts) (5½-Digits)

Range	Frequency	90 Days, 18°C to 28°C	
		Avg-Res Current	True RMS Current
100 μA	10 Hz - 20 Hz	—	1.0 + 110
	20 Hz - 50 Hz	0.8 + 9	0.8 + 35
	50 Hz - 10 kHz	0.4 + 9	0.4 + 35
	10 kHz - 20 kHz	0.7 + 9	1.0 + 110
	20 kHz - 50 kHz	1.5 + 9	1.5 + 260
	50 kHz - 100 kHz	3.0 + 9	4.0 + 760
1 mA and 10 mA	10 Hz - 20 Hz	—	1.0 + 110
	20 Hz - 50 Hz	0.5 + 9	0.5 + 35
	50 Hz - 10 kHz	0.06 + 9	0.11 + 35
	10 kHz - 20 kHz	0.11 + 9	0.2 + 110
	20 kHz - 50 kHz	0.12 + 9	0.3 + 260
	50 kHz - 100 kHz	0.51 + 9	1.0 + 760
100 mA	10 Hz - 20 Hz	—	1.0 + 150
	20 Hz - 50 Hz	0.5 + 55	0.5 + 80
	50 Hz - 10 kHz	—	0.26 + 80
	50 Hz - 100 kHz	0.24 + 55	—
1A	10 Hz - 20 Hz	—	1.0 + 160
	20 Hz - 50 Hz	0.5 + 65	0.5 + 90
	50 Hz - 10 kHz	0.24 + 65	0.26 + 90

**Applies from 0.1% of full scale to full scale*

Crest Factor (True-RMS): >4.5 at full scale, increasing down scale by $4.5 \sqrt{I_{range} \div I_{input}}$

Calibration Memory Option (-04)
Allows correction factor to be entered and stored for any or all ranges of any or all measurement functions, quickly and conveniently. Prevents downtime in calibration laboratory.
Control: Via front panel pushbuttons
Storage Time: 1 year if not used. Up to five years if used
Calibration Points: Decade value for each range

IEEE Interface Option (-05)
The IEEE Interface provides I/O compatability per IEEE Std 488-1978. Order 1m, 2m, or 4m cable separately (Y8021, Y8022, Y8023)

RS-232 Interface Option (-06)
This bit serial asynchronous interface option provides either voltage loop (EIA Standard RS-232-B or -C) or current loop (20 mA for Teletype) for interfacing to such things as computers, CRT displays, DEC writers, Teletypes, etc. Eight baud rates are available from 110 to 9600 and either one or two stop bits can be set up. Selection is made via rear panel logic switches.

Parallel Interface Option (-07A)
This 16-bit parallel, character-serial interface option allows the 8502A to interface to PDP11 mini-computers at a full 500 readings/second. Can be used for interfacing to 8-bit multiplex microcomputers or controllers. Both ASCII and binary (2's complement) coding are selected via command codes.

General Specifications

Temperature: 0°C to 50°C, operating; -40°C to 70°C, non-operating
Overload: LO to guard is 100V max; guard to chassis is 1000V max
Power: 100, 120, 220 or 240 Volt, 47-63 Hz <25W with all options
Warmup: 1 hr to rated accuracy
Dimensions: 10.8 cm H x 42.5 cm L x 43.2 cm W (4.25 in H x 16.75 in L x 17 in W)
Weight: Basic is 9.1 kg (20 lb). All options are 11.3 kg (25 lb)
Included: Manual and power cord. (Order Y8133 or Y8140 test leads separately.) Serialized and dated calibration certification sheet

Model

February 1987 prices

8502A DMM $5010

Options*

8500A-01 Average Converter 615
8500A-02 Ohms Converter 770
8500A-03 Current Converter 510
8500A-04 Cal Memory 495
8500A-05 IEEE-488 Interface 530
8500A-06 RS-232-C Interface 530
8500A-07A Parallel Interface (for DEC PDP11, DR11C, DRV11) 530
8500A-09A RMS Converter 670
8500A-16 Switchable Front/Rear Inputs 525
**All options except -16 are customer installable*

Accessories (Also see page 63)

MIS-7011K Extender Card 135
MIS-7013K Bus Interconnect and Monitor 45
MIS-7190K Static Test Controller 285
MIS-7191K Test Module 475
M00-260-610 18" Rack Slide Kit (needs M04-205-600) 105
M00-270-610 20" Rack Slide Kit (needs M04-205-600) 110
M00-280-610 24" Rack Slide Kit (needs M04-205-600) 110
M04-205-600 5¼" Rack Adapter 95
Y8021 1m, IEEE-488 Shielded Cable 85
Y8022 2m, IEEE-488 Shielded Cable 95
Y8023 4m, IEEE-488 Shielded Cable 105
Y8133 Universal Test Leads 20
Y8140 Slim Test Leads 18
Also see page 284 for more accessory information.

Service & Support

Warranty
One-year extended warranty. Calibration warranted during calibration cycle. (See page 269 for further information on warranty and calibration.)

Extended Warranty
SC1-8502A Repair (with calibration) 469
SC1-8502A Repair (calibrated w/incoming or outgoing data) .. 569
SC1-8502A Repair (calibrated w/incoming & outgoing data) .. 669
SC2-8502A Calibration (1/yr recommended) 157
SC2-8502A Calibration (1/yr w/incoming or outgoing data) ... 257
SC2-8502A Calibration (1/yr w/incoming & outgoing data) ... 357

Training
8500 Series Maintenance Training (See page 273 for more details) ... 1100

Spare Parts
Recommended spare parts kits are available. Contact Replacement Parts Dept. at (800) 526-4731 in most of U.S.A., (206) 356-5774 from WA, for more details. Module exchange is available on this instrument. (See page 272.)

Ordering Information (See page 306)