

Section 1

Introduction and Specifications

1-1. INTRODUCTION

1-2. This manual provides comprehensive information for installing, operating and maintaining your John Fluke Model 8522A Digital Multimeter. Complete descriptions and instructions are included for the instrument mainframe.

1-3. DESCRIPTION

1-4. The John Fluke Model 8522A Digital Multimeter is designed for use in an automated test system or for use as an independent device. The 5½-digit instrument can be operated locally from the front panel or remotely via a BCD/Parallel (remote) interface. The 8522A can directly measure dc, ac, and ac + dc voltage; resistance (both 2-and 4-wire); and conductance (the reciprocal of resistance). While the range of measurement can be manually selected, all functions except conductance (nS) have full autoranging capabilities (conductance only has one range). When measurement function and range are selected, the 8522A automatically programs the reading rate and filter for optimum measurement accuracy. Other values for reading rate and filter can be manually selected. The fourteen math programs allow more sophisticated processing of measurement data (such as computing the peak-to-peak value, percentage of deviation, rise time, etc.) and additional measurement functions. For example, the standard 8522A can make voltage ratio measurements, dB measurements, and temperature measurements in addition to the direct voltage and resistance measurements. The burst feature of the 8522A allows the operator to capture up to 400 readings at various reading rates and to display the readings at a different rate, to delay the time after a trigger before the readings are taken, or to look at what happened to the signal before the trigger occurred. The TRIGGER controls allow internal triggering, manual triggering via the remote interface, and triggering from an external source. All measurements can be guarded.

1-5. DC voltages can be measured from 1 μ V up to 1000V in five ranges: 100 mV, 1V, 10V, 100V, and 1000V. AC and ac + dc voltages can be measured from 10 μ V ac rms to 650V ac rms in four ranges (1V, 10V, 100V, and 650V ac rms) over the frequency range of 10 Hz to 1 MHz.

1-6. Resistance can be measured in two ways. Either directly using the Ω 2 WIRE and Ω 4 WIRE functions or inversely using the conductance function. The Ω 2 WIRE and Ω 4 WIRE functions provide measurement of resistance from 100 microhms to 20 megohms in seven ranges: 10 ohms, 100 ohms, 1000 ohms, 10 kilohms, 100 kilohms, 1 megohm, and 10 megohms. Conductance provides fast, accurate, noise-free measurement of resistances from 10 megohms up to 10,000 megohms in a single range, 100 nS. Conductance is displayed in Siemens (international units) which is equal to the reciprocal of ohms ($S = 1/\Omega$).

1-7. The standard 8522A has fourteen math programs:

- | | | |
|-----|------|--|
| #1 | TEST | Four diagnostic self-test programs. |
| #2 | ZERO | Automatic meter zeroing for dc voltage offsets and resistance offsets (such as test lead resistance). |
| #3 | XREF | Ratio between the input voltage and an external reference voltage. |
| #4 | OSR | Subtracts an offset (OFST) from the input, multiplies by a scale factor (SCAL), divides by a ratio factor (RATO), and displays the result. |
| #5 | PCT | Displays the percentage deviation of the input with respect to a stored nominal value. |
| #6 | PEAK | Captures upper and lower peak values and computes peak-to-peak value. |
| #7 | LIM | Tests the reading against stored upper and lower limits and displays the results of each reading, the number HIGH, the number LOW, the number that PASS, and the TOTAL number of readings. |
| #8 | STAT | Statistics program that computes mean deviation, standard deviation, variance, number of reading, bias, sum of the squares, sum of readings, difference, and the sum of the differences. |
| #9 | LFAC | Computes the ac rms value of inputs 10 Hz and below. |
| #10 | dB | Computes dB, dBm, or dBV. |
| #11 | RTD | RTD thermometer measurements. |
| #12 | JV C | Works with the John Fluke 80T-150C to measure temperature in °C. |
| #13 | JV F | Works with the John Fluke 80T-150F to measure temperature in °F. |
| #14 | THMS | Thermistor linearization. |

1-8. These 14 programs can be exercised on measurement data while the readings are being taken or after the readings have been captured in burst memory.

1-9. OPTIONS AND ACCESSORIES

NOTE

Math programs #8 through #14 are standard in the 8522A. However, throughout this manual they have been referred to as Option -010.

1-10. The 8522A has one option, the Option -010. This is a software option which provides an additional seven math programs (#8 through #14) and an additional 350 locations of burst memory. The accessories available for use with the 8522A are listed in Table 1-1.

1-11. LIST OF RECOMMENDED TEST EQUIPMENT

1-12. Table 1-2 lists the test equipment required to complete the Performance tests and calibration procedures described in this manual. Equivalent instruments can be substituted if the recommended models are not available

1-13. SPECIFICATIONS

1-14. Table 1-3 lists the specifications for the 8522A.

Table 1-1. 8522A Accessories

MODEL OR PART NO.	NAME
Y8599	Rack Ears (for Rack Slide Mounting)
Y8598	22-inch Rack Slides and Ears
80F-5	High Voltage Probe
80F-15	High Voltage Probe
81RF	High Frequency Probe
82RF	High Frequency Probe
Y2037	100Ω RTD Temperature Probe
80T-150C	Universal Temperature Probe (°C)
80T-150F	Universal Temperature Probe (°F)
Y8597	Interface Adapter (8522A to 8375A/8400A)

Table 1-2. Test Equipment

ITEM	SPECIFICATIONS (MINIMUM)	NOMENCLATURE
DMM	5½ digits 0.005% dc accuracy	FLUKE 8800A
Oscilloscope	General Purpose	TEKTRONIX T900 Series
DC Voltage Standard	0.001% Accuracy	FLUKE 332D or 335D
Ratio Standard	0.1 ppm Resolution, 1 ppm Terminal Linearity	FLUKE 720A
AC Calibrator	≥0.03% Accuracy @ 20 kHz	FLUKE 5200A
Power Amplifier	≥0.44% Accuracy @ 20 kHz	FLUKE 5205A or 5215A
Standard Resistor w/Accessories		ESI 1010 100Ω and 10 kΩ, ESI 1050 1MΩ. ESI SB103 shorting bars, ESI PC101 Parallel Compensation Network
Load	1 MΩ/1 μF	1 MΩ ±1% 1/8 W, mF resistor in parallel with a 1 μF ±20% 10V capacitor

Table 1-3. 8522A Specifications

DC VOLTS			
Input Characteristics			
RANGE	FULL-SCALE	RESOLUTION	INPUT RESISTANCE
100 mV	199.999	1 μ V	$\geq 10,000 \text{ M}\Omega$
1V	1.99999	10 μ V	$\geq 10,000 \text{ M}\Omega$
10V	16.0100	100 μ V	$\geq 10,000 \text{ M}\Omega$
100V	130.000	1 mV	10 $\text{M}\Omega$
1000V	1024.00	10 mV	10 $\text{M}\Omega$

Accuracy \pm (% of input + number of digits)

RANGE	24 HOURS 23°C \pm 1°C	90 DAYS 18°C to 28°C	1 YEAR 18°C to 28°C	PLUS TEMP. COEFFICIENT PER °C*
100 mV	0.003 +5	0.0065 + 6	0.011 + 10	0.0005 + 0.5
1V	0.003 + 1	0.006 + 2	0.011 + 2	0.0005 + 0.15
10V	0.002 + 1	0.005 + 1	0.009 + 1	0.0004 + 0.10
100V	0.003 + 1	0.007 + 2	0.012 + 2	0.0005 + 0.15
1000V	0.0035 + 1	0.0065 + 1	0.011 + 1	0.0005 + 0.10

*From 22°C to 0°C or 24°C to 50°C, 24 hour specification
From 18°C to 0°C or 28°C to 50°C, 90 day or 1 year specification

High Speed Accuracy \pm (% of input + least significant bit)*

RANGE	90 DAYS 18°C to 28°C	1 YEAR 18°C to 28°C	PLUS TEMP. COEFFICIENT PER °C*
100 mV	0.01 + 1	0.015 + 1	0.001 + .1
1V	0.01 + 1	0.015 + 1	0.001 + .05
10V	0.01 + 1	0.015 + 1	0.001 + .05
100V	0.01 + 1	0.015 + 1	0.001 + .05
1000V	0.01 + 1	0.015 + 1	0.001 + .05

*Typical with 60Hz line, remote operation, 500 readings per second, 2-byte binary output with 14 bits of data.

Typical Normal Mode Rejection

LINE FREQ	FILTER SETTLING TIME					
	25 ms	50 ms	100 ms	200 ms	500 ms	1s
50 Hz	65 dB	68 dB	71 dB	80 dB	*83 dB	86 dB
60 Hz	65 dB	68 dB	71 dB	85 dB	*88 dB	91 dB
400 Hz	53 dB	56 dB	60 dB	120 dB	*123 dB	126 dB

*Guaranteed minimum rejection

Common Mode Rejection True 100 dB at 50 Hz and 60 Hz with 1 k Ω unbalance in either lead. Effective CMR is equal to normal mode rejection plus true CMR.

Maximum Input $\pm 1000\text{V}$ Peak, HI to LO or GUARD to chassis terminals, and $\pm 200\text{V}$ Peak, GUARD to LO terminals, for any range.

Table 1-3. 8522A Specifications (cont)

Maximum Reading Rate

OPERATION	RESOLUTION	LINE	READING RATE
Local (Parallel)	5½ digits	50 Hz	100 rdgs/sec
		60 Hz	120 rdgs/sec
Remote (Parallel)	5½ digits	50 Hz	200 rdgs/sec
		60 Hz	240 rdgs/sec
Remote (Parallel)	4½ digits	50 Hz	>500 rdgs/sec
		60 Hz	>500 rdgs/sec
BCD	5½ digits	50 Hz	50 rdgs/sec
		60 Hz	60 rdgs/sec

Input Current ≤50 pA for 30 days @ 18°C to 28°C

AC VOLTS (TRUE RMS)

Input Characteristics

RANGE	FULL-SCALE	RESOLUTION	INPUT IMPEDANCE
1V	1.99999	10 μV	1 MΩ, ≤100 pF at the V/Ω INPUT terminal
10V	16.0100	100 μV	
100V	130.100	1 mV	
650V	650.00	10 mV	

Accuracy ±(% of input + % of full-scale)**

For 650V range multiply % FS error shown by 1.6

FREQUENCY	24 HOURS 23°C ±1°C			90 DAYS 23°C to 28°C			1 YEAR 18°C to 28°C		
	% OF INPUT	+ % FS AC	+ % FS AC+DC	% OF INPUT	+ % FS AC	+ % FS AC+DC	% OF INPUT	+ % FS AC	+ % FS AC+DC
10 Hz to 20 Hz*	3.0	0.5	0.6	3.0	0.6	0.7	3.5	0.6	0.7
20 Hz to 40 Hz*	0.4	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.7
40 Hz to 20 kHz	0.08	0.02	0.06	0.1	0.03	0.08	0.15	0.05	0.16
20 kHz to 100 kHz	1.0	0.3	0.4	1.0	0.3	0.4	2.0	0.6	0.8
100 kHz to 300 kHz	2.4	0.6	0.6	2.4	0.6	0.6	4.0	1.0	1.0
300 kHz to 1 MHz	8.0	2.5	2.5	8.0	2.5	2.5	15.0	5.0	5.0

*Assumes smoothing using the Statistics Math Program (#8)

**From 0.1% of range to full scale

Temperature Coefficient 18°C to 0°C to 28°C to 50°C, to 20 kHz.

AC MODE ±(.007% of input + .007% FS)/°C

AC + DC MODE ±(.007% of input + .014% FS)/°C

Maximum Input ±1000V, Peak HI to LO or GUARD to chassis terminals, and ±200V Peak GUARD to LO terminals for any range.

Volt-Hertz Product ≤2x10⁷ (slew rate ≤177V/uSec)

Crest Factor Exceeds 4:1 @ full scale, increasing downscale.

Maximum Reading Rate 10 rdgs/sec. For frequencies <300 Hz use slower reading rates of 5, 2, or 1 RDG/S, to insure stated accuracy.

Table 1-3. 8522A Specifications (cont)

OHMS**Input Characteristics**

RANGE	FULL-SCALE	RESOLUTION	CURRENT THRU UNKNOWN	OPEN CIRCUIT VOLTAGE
10Ω	19.9999	100 μΩ	10 mA	<8V
100Ω	199.999	1 mΩ	10 mA	
1000Ω	1999.99	10 mΩ	1.0 mA	
10 kΩ	19.9999	100 mΩ	0.1 mA	
100 kΩ	199.999	1Ω	14.5 μA (max)	
1 MΩ	1.99999	10Ω	1.5 μA (max)	
10 MΩ	19.9999	1 kΩ	1.5 μA (max)	

Accuracy ±(% of input + number of digits)

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
10Ω	0.0045 + 6	0.0080 + 7	0.0140 + 12	0.0007 + 0.2
100Ω	0.0035 + 2	0.0070 + 2	0.0125 + 3	0.0007 + 0.2
1000Ω	0.0035 + 2	0.0070 + 2	0.0125 + 3	0.0007 + 0.2
10 kΩ	0.0035 + 2	0.0070 + 2	0.0125 + 3	0.0007 + 0.2
100 kΩ	0.0040 + 2	0.0090 + 2	0.0140 + 3	0.0012 + 0.2
1 MΩ	0.0090 + 2	0.0160 + 2	0.0200 + 3	0.0020 + 0.2
10 MΩ	0.0300 + 1	0.0440 + 1	0.0450 + 3	0.0030 + 0.2

*From 18°C to 0°C or 28°C to 50°C

Maximum Input ±400V peak for any range.**Maximum Reading Rate** 10/SEC at 100 kΩ and above.

OPERATION	RESOLUTION	LINE	READING RATE
Local (Parallel)	5½ digits	50 Hz	100 rdgs/sec
		60 Hz	120 rdgs/sec
Remote (Parallel)	5½ digits	50 Hz	200 rdgs/sec
		60 Hz	240 rdgs/sec
Remote (Parallel)	4½ digits	50 Hz	>500 rdgs/sec
		60 Hz	>500 rdgs/sec
BCD	5½ digits	50 Hz	50 rdgs/sec
		60 Hz	60 rdgs/sec

CONDUCTANCE**Range** 100 nS**Full-Scale** 202.00 nS**Resolution** 0.01 nS**Accuracy ±(% of input + number of digits)**

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
0.04 + 5	0.05 + 5	0.06 + 5	0.004 + 1

*From 18°C to 0°C or 28°C to 50°C

Table 1-3. 8522A Specifications (cont)

Maximum Input $\pm 400V$ peak

Maximum Reading Rate 10 rdgs/sec

EXTERNAL REFERENCE

Operating Range $\pm 0.5V$ dc to $\pm 33V$ dc as long as external reference is within $\pm 16.5V$ of input LO terminal.

Input Impedance 10,000 M Ω between external reference HI or LO terminals and input LO terminals.

Accuracy

X-REF VOLTAGE	ACCURACY
16.5V to 33V	$\pm(A + B + 20 \text{ ppm})$
0.5V to 16.5V	$\pm A + B + (400 \text{ ppm} \div V_{\text{ref}})$

NOTE: A = DC 10 volt range accuracy
 B = Input voltage or resistance range accuracy

Maximum Input $\pm 180V$ peak between external reference HI or LO and input LO; $\pm 360V$ peak between external reference HI and LO.

Transfer Accuracy The following accuracy specifications apply when:
 Filter settling time is 500 or 1000 ms.
 Measurements are made more than 2 hours after warm-up.
 Measurements are made within one range.
 Standard is checked at least every hour.
 Ambient temperature stability within $\pm 1^\circ C$.

DC VOLTAGE

RANGE	$\pm(\% \text{ of input} + \text{number of digits})$
100 mV	0.0020 + 4
1V	0.0020 + 1
10V	0.0010 + 1
100V	0.0020 + 1
1000V	0.0020 + 1

AC VOLTAGE (all ranges)

FREQUENCY	$\pm(\% \text{ of input} + \% \text{ of full scale})$
10 Hz to 20 Hz	1.0 + 0.2
20 Hz to 40 Hz	0.1 + 0.1
40 Hz to 20 kHz	0.005 + 0.007
20 kHz to 100 kHz	0.100 + 0.030
100 kHz to 1 MHz	0.500 + 0.060

AC VOLTAGE, DC COUPLED Same as AC Voltage except 40 Hz - 20 kHz, 0.005 + 0.010.

Table 1-3. 8522A Specifications (cont)

Resistance

RANGE	±(% of input + number of digits)
10Ω	0.0030 + 5
100Ω	0.0020 + 2
1000Ω	0.0020 + 2
10 kΩ	0.0020 + 2
100 kΩ	0.0020 + 2
1 MΩ	0.0050 + 2
10 MΩ	0.0100 + 1

Conductance ±(0.02% of input +0.02 nS)

GENERAL

Interface BCD or Parallel (word serial)

Temperature 0°C to 50°C operating; -25°C to 75°C non-operating.

Relative Humidity ≤95% at 25°C, ≤75% at 40°C, ≤45% at 50°C.

Shock and Vibration Meets MIL-T-28800B for type III, Class 5, style E.

Power 100, 120, 220, or 240V ac, ±10%; 50, 60, or 400 Hz ±5%, ≤50W.

Size 8.89 cm H/47.00 cm L/43.18 cm W (3-1/2 in H/18-1/2 in L/17 in w) See Figure 1-1.

Weight 9.56 kg (21 lbs)

Protection Class Code 1 Relates solely to insulating or grounding properties in IEC 348.