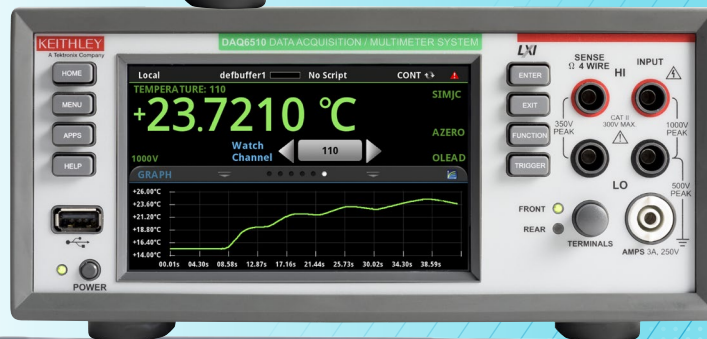# DIGITAL MULTIMETER
SELECTOR GUIDE

KEITHLEY
A Tektronix Company

Tektronix®

Touch, Test, Invent®

Combining touchscreen productivity with 15 measurement functions, greater sensitivity, and more connectivity

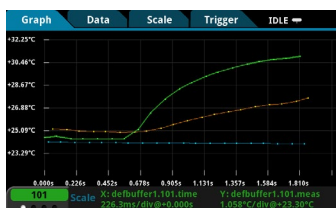## DAQ6510 DATA ACQUISITION AND LOGGING MULTIMETER SYSTEM

Creating a new level of simplicity, the DAQ6510 touchscreen user interface enables faster setup time, real time monitoring of test status, and detailed data analysis on the instrument.

• Set up, execute and monitor, and analyze multi-channel measurements quickly
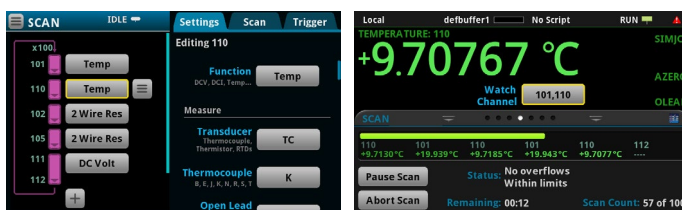
Set up

Monitor

Analyze

• Built-in 6½-digit DMM for high performance measurements

DMM6500 6½-DIGIT BENCH/SYSTEM DIGITAL MULTIMETER

The DMM6500 offers more measurement capability – including transient capture, data visualization, and analysis – at a great price.

• 15 built-in measurement functions and increased sensitivity for a wider range of measurements

• Analyze graphs and trends directly on the touchscreen display for faster measurement insights
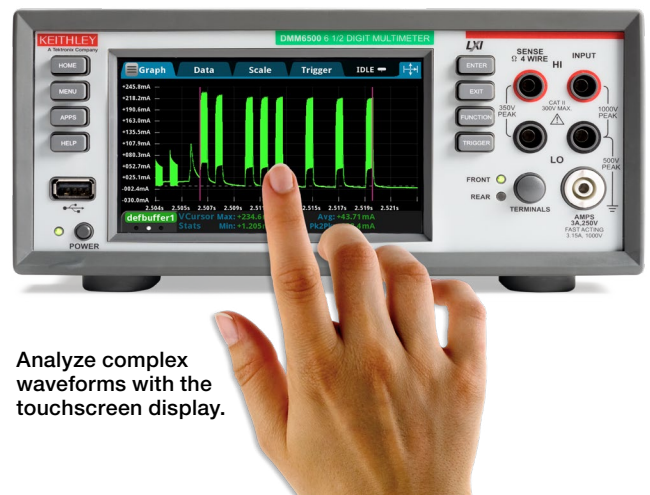
Analyze complex waveforms with the touchscreen display.

Keithley has a wide selection of your most important measurement instrument.

STANDARD PERFORMANCE FOR THE MOST ESSENTIAL NEEDS

2110 5½-Digit Dual-Display Digital Multimeter

- Measure and display two parameters concurrently
- Sample a signal at 50,000 readings/s
- Measure temperature and capacitance
- Interface to a PC or a system with the USB interface or the optional GPIB interface

Learn more about the 2110

Efficiently conduct laboratory exercises in student labs with Tek SmartLab™ Software and instrumentation including the 2110 DMM.
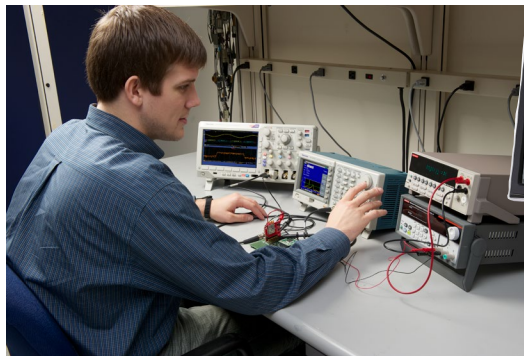
2100 6½-Digit USB Digital Multimeter

- Connect to either the front terminals or the rear terminals
- Measure any parameter with fully-specified accuracies
- Interface to a PC with the USB-TMC compliant protocol

Learn more about the 2100

ENHANCED PERFORMANCE WITH A TOUCHSCREEN GRAPHICAL USER INTERFACE

DMM6500 6½-Digit Bench/System Digital Multimeter

- Capture complex signals and transients with up to 1 Msample/s 16-bit digitizing
- Make low level measurements with 100 nV, 10 pA, and 1 µΩ sensitivities
- Measure with superior 0.0025% basic, 1-year, DC Volt accuracy and 0.0075% basic, 1-year resistance accuracy
- Analyze data and display waveform plots on the 5 inch (12.7 cm) touchscreen display
- Measure power circuit current up to 10 A
- Interface to a PC with LAN/LXI and USB-TMC interfaces or optional GPIB or RS-232 interfaces
- Test up to 10 DUTs in one test setup with the optional plug-in scanner cards
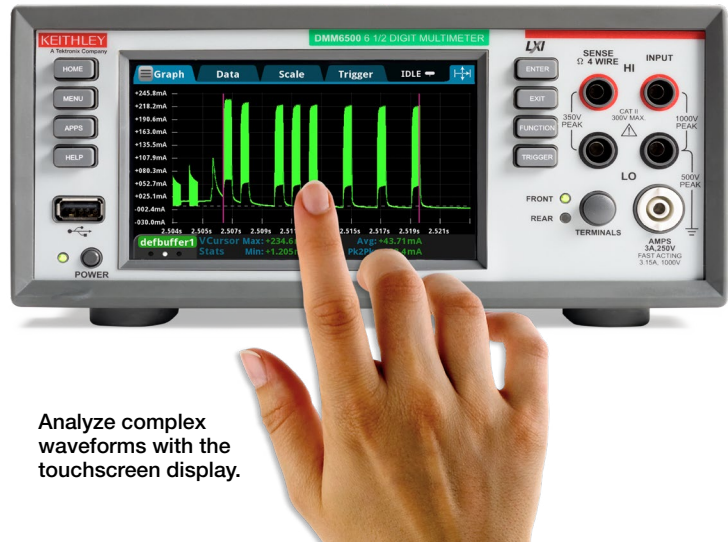
Analyze complex waveforms with the touchscreen display.

Learn more about the DMM6500
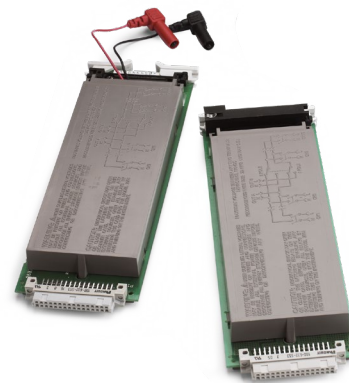
Use the optional scanner cards to increase measurement capability for voltage measurements from 10 different channels or for temperature measurements from 9 different thermocouples.

Use the optional TSP-Link interface and TSP (Test Script Processor) scripts to control test sequences and to control other instruments with the DMM6500. Save test time with minimal communication with the PC and achieve low-latency synchronization between instruments.

NO COMPROMISE: HIGH SPEED AND HIGH ACCURACY

DMM7510 7½-Digit Graphical Sampling Multimeter

- Capture IoT wireless device load current transmit bursts wit 18-bit, 1Msample/s digitizing
- Measure ultra-low sleep mode currents on processors and products with 1 pA current sensitivity
- Hold DUTs to tight test tolerances using voltage measurements with accuracies as low as 14 ppm
- Store up to 27.5 million readings for profiling load current waveforms and transient waveforms
- Take measurements as fast as 26,000 readings/s for high throughput testing
- Get fast insight into waveform characteristics with the 5 inch (12.7 cm) touchscreen display
- Execute custom test scripts and control other instruments with the built-in test script processing language
- Interface to a PC with either LXI LAN, USB, or GPIB interfaces

Learn more about the DMM7510
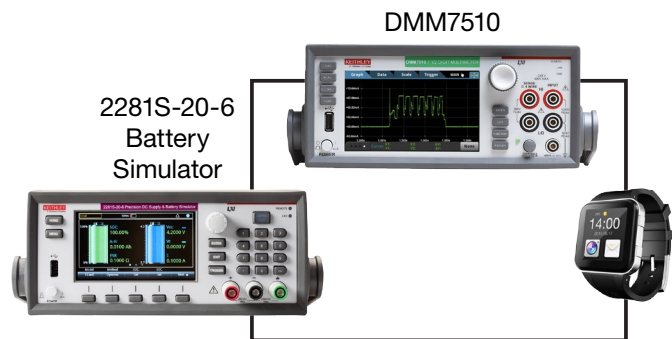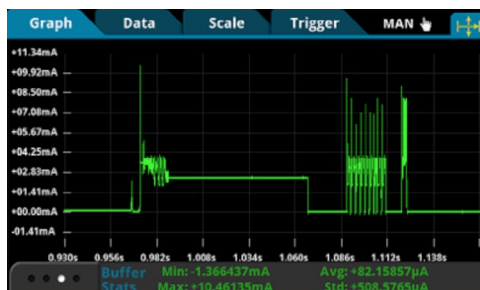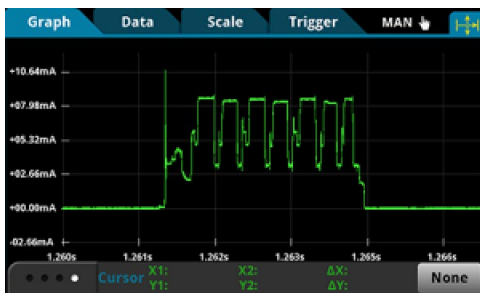
Use the high resolution and the wide dynamic range of the DMM7510 to capture the current draw during all the operating states (sleep mode, standby mode, and transmit mode) of an IoT device.

SAVE RACK SPACE AND DOUBLE TEST CAPACITY IN MANUFACTURING

DMM7512 Dual Channel 7½-Digit Sampling Multimeter

Learn more about the DMM7512

- Double measurement performance with two independent, identical 3½- to 7½-digit DMMs similar to the DMM7510 in a 1U high, full rack width chassis
- Capture waveforms such as battery drain currents with up to 1 Msample/s, 18-bit digitizing and 0.1 nA and 1 µV sensitivities
- Simultaneously capture voltage and current waveforms to determine a device's instantaneous peak and average power
- Evaluate low power components including quiescent or sleep mode states with 10 nV, 0.1 µΩ, and 1 pA sensitivities
- Make high accuracy, low resistance measurements with offset compensated Ohms, four-wire measurement, and dry circuit voltage control
- Maximize test uncertainty ratios based on 1-year DV volts accuracies as good a 14 ppm.
- Reduce test time by executing test scripts with the Embedded Test Script Processor, which saves PC command communication overhead.
- Obtain tight synchronization between the two DMMs using TSP-Link® communication
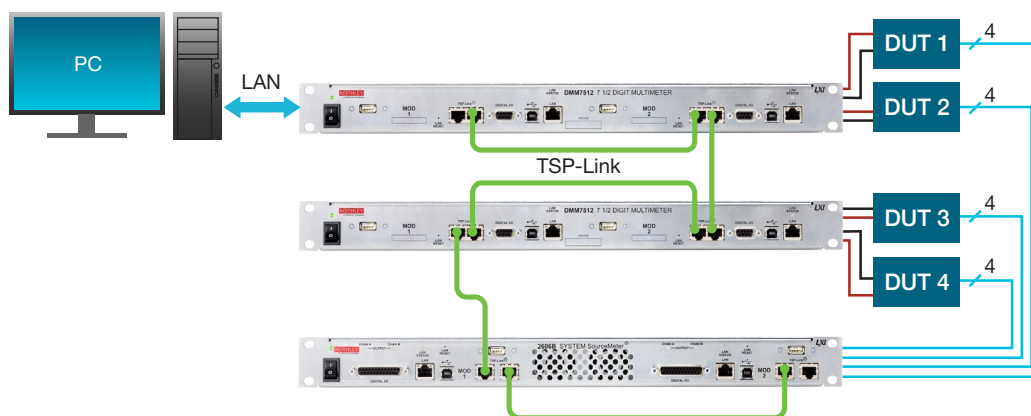
Source and measure multiple DUTs with the compact, high density configuration of the dual-DMM DMM7512 and the four-channel 2606B System SourceMeter SMU Instrument. To maximize test speed, use a test script to execute testing with one master instrument and control all instruments with the TSP-Link interface.

HIGH ACCURACY WITH HIGH RESOLUTION

2010 Low Noise 7½-Digit Autoranging Multimeter

- Resolve low voltages with the 100 nVrms noise floor
- Make automatic ratio measurements on two voltages with the front and rear inputs
- Minimize device self-heating with low power resistance measurements
- Avoid breaking down oxides or films on relay contacts and connectors with the dry circuit test function
- Test up to 10 DUTs with an optional voltage or temperature plug-in scan card
- Interface to a PC with the RS-232 or the GPIB interface

Learn more about the 2010

2001 7½-Digit High Performance Multimeter

- Capture spikes as narrow as 1µs with the peak detector function
- Perform in-circuit current measurements without breaking the circuit
- Automatically separate components based on measurement limits using the Binning function
- Measure up to 10 channels of voltage or 9 channels of temperature with the optional plug-in scanner cards
- Make high accuracy, 2 MHz bandwidth AC voltage measurements for control system analysis
- Connect to a PC with the GPIB interface

Learn more about the 2001

2002 8½-Digit High Performance Multimeter

- Make the most accurate voltage measurements with tolerances as narrow as 10 ppm
- Capture spikes as narrow as 1 µs with the peak detector function
- Perform in-circuit current measurements without breaking the circuit
- Automatically separate components based on measurement limits using the Binning function
- Measure up to 10 channels of voltage or 9 channels of temperature with the optional plug-in scanner cards
- Make high accuracy, 2 MHz bandwidth AC voltage measurements for control system analysis
- Connect to a PC with the GPIB interface

Learn more about the 2002

PRECISION MULTI–CHANNEL MEASUREMENTS FOR DATA ACQUISITION

2750 Multimeter/Switch System

- Build a test system as large as 200 differential input channels
- Design a versatile system using up to 5 different models of the 7700-series plug-in switch modules in a 2750
- Measure low resistive components with 1 µΩ sensitivity
- Use the dry circuit function to protect sensitive devices from damage and to minimize self-heating errors during testing
- Make measurements with the high performance 6½-digit DMM
- Interface to a PC with the GPIB or RS-232 interface

Learn more about the 2750

PRECISION MULTI–CHANNEL MEASUREMENTS WITH BOTH MORE PERFORMANCE AND WITH THE MOST SIMPLIFIED SETUP PROCEDURE

DAQ6510 Data Acquisition and Logging, Multimeter System

- Set up a test in minutes with the 5-inch (12.7 cm) touchscreen display and graphical user interface
- Test low power devices with current sensitivity down to 10 pA
- Save upgrade costs by using the same plug-in switch modules as the 2750
- Monitor up to 80 channels of thermocouple, RTD, or thermistor temperature measurements
- Monitor fast-changing signals with the 1 Msample/s, 16-bit digitizer
- Make high precision measurements with the high performance 6½-digit DMM
- Interface to a PC with either LAN LXI or USB or add an RS-232 or a GPIB option
- Control other instruments and execute a test with the built-in scripting code and the Test Script Processor (TSP®), TSP-Link® I/O option

Learn more about the DAQ6510

Obtain data while an environmental test is in process for faster access to test results.

HIGH CHANNEL COUNT AND PRECISION MEASUREMENT DATA ACQUISITION SYSTEMS

3706A System Switch/Multimeter

- Build a test system with as many as 576 two-wire or 720 one-wire multiplexed channels or with up to 2,688 matrix crosspoints
- Fill up to 6 slots with 10 different 3700 Series plug-in switch modules
- Make the most accurate measurements with the 7½-digit DMM and 13 measurement functions
- Maximize throughput with measurement speeds up to 14,100 readings/s
- Minimize time-consuming interaction with a PC by using the 3706A as a master system controller using Keithley's internal Test Script Processor (TSP™) software
- Control other LAN-based instruments with the TSP-Link interface
- Interface to a PC with LAN/LXI, USB, or GPIB interfaces

Learn more about the 3706A
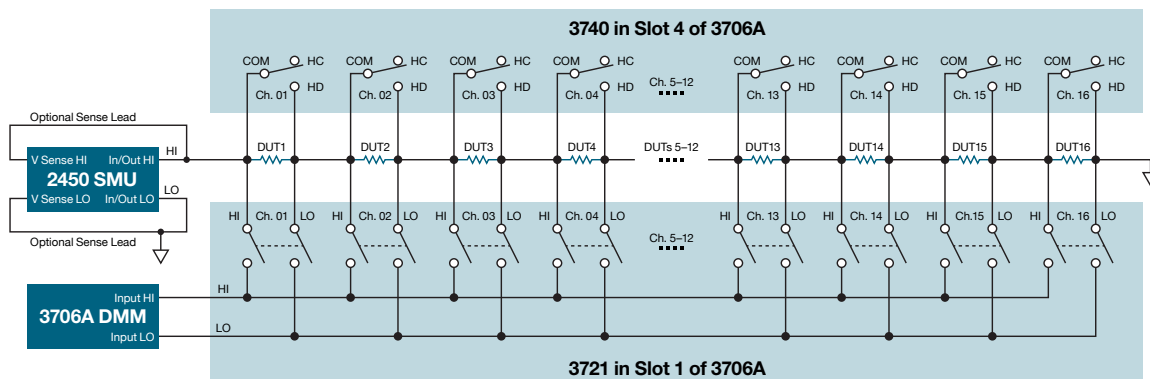
16-pin connector test system using a 2450 Source-Measure Instrument and a 3706A with 3740 and 3721 Multiplexer Plug-In Modules

Appendix 1: Plug-in Scanner Card Options for the DMM6500, 2001, 2010, and 2002 Digital Multimeters

	2000-SCAN	2001-TCSCAN
Number of Channels	10	9
Card Configuration	Multiplexer	Multiplexer
Input Configuration	Differential, 2-pole inputs	Differential, 2-pole inputs
Max Voltage	110 VDC, 175 VAC Peak	110 VDC, 175 VAC Peak
Max Current Switched	1 A	1 A
Comments	Can configure as 5-channel with 4-pole relays	Built-in thermocouple cold-junction temperature compensation. Can configure as 4-channel with 4-pole relays

Appendix 2: Plug-in Switch Modules for the DAQ6510 Data Acquisition System

Module	7700	7701	7702	7703	7705	7706	7707	7708	7709	7710	7711	7712
Description	20 Channel, Differential Multiplexer Module	32 Ch. Differential Multiplexer Module	40 Ch. Differential Multiplexer Module	32 Ch. High Speed, Differential Multiplexer Module.	40 Ch. Single-pole Control Module	All-in-One I/O Module.	32 Ch. Digital I/O Module	40 Ch. Differential Multiplexer Module	6×8 Matrix Module.	20 Ch. Solid-state Differential Multiplexer Module	2 GHz 50 Ω RF Module	3.5 GHz 50 Ω RF Module
# Analog Inputs	20	32	40	32	40	20	10	40	48	20	8	8
Configuration	Multiplexer w/CJC	Multiplexer	Multiplexer	Multiplexer	Independent SPST	Multiplexer w/CJC	Digital I/O/ Multiplexer	Multiplexer w/CJC	Matrix	Multiplexer w/CJC	Multiplexer	Multiplexer
	1×20 or two 1×10	1×32 or two 1×16	1×40 or two 1×20	1×32 or two 1×16	N/A	1×20 or two 1×10	1×10 or two 1×5	1×40 or two 1×20	6×8	1×20 or two 1×10	Dual 1×4	Dual 1×4
Type of Connector	Screw terminals	D-sub	Screw terminals	D-sub	D-sub	Screw terminals	D-sub	Screw terminals	D-sub	Removable screw terminals	SMA	SMA
Max. Voltage	300 V	150 V	300 V	300 V	300 V	300 V	300 V	300 V	300 V	60 V	60 V	42 V
Max. Switched Current	1	1 A	1 A	500 mA	2 A	1 A	1 A	1 A	1 A	0.1 A	0.5 A	0.5 A
Bandwidth	50 MHz	2 MHz	2 MHz	2 MHz	10 MHz	2 MHz	2 MHz	2 MHz	2 MHz	2 MHz	2 GHz	3.5 GHz
Contact Life [1]	10^8	10^8	10^8	10^8	10^8	10^8	10^8	10^8	10^8	10^{10}	10^6	10^6
Switch Speed	3 ms	3 ms	3 ms	1 ms	3 ms	3 ms	3 ms	3 ms	3 ms	0.5 ms	10 ms	10 ms
Other	Maximum power = 125 VA. 2 current measure channels.	Maximum power = 125 VA.	Maximum power = 125 VA. 2 current measure channels.	Reed relays.	Maximum power = 125 VA.	2 analog outputs. 16 digital outputs. Maximum power = 125 VA. Event Counter/ Totalizer	32 digital I/O. Maximum power = 125 VA.	Maximum power = 125 VA.	Connects to internal DMM. Daisy chain multiple cards for up to a 6×40 matrix. Maximum power = 125 VA.	Solid state relays, 60 V max. 500 channels/ second scan rate.	Insertion loss <1.0 dB @ 1 GHz. VSWR <1.2 @ 1 GHz.	Insertion loss <1.1 dB @ 2.4 GHz.

1. No load contact life. See card data sheet for additional specifications.

Appendix 3: Plug-in Switch Modules for the 3706A System Switch/Multimeter

	3720	3721	3722	3723	3724	3730	3731	3732	3740	3750
No. of Channels	60 (Dual 1×30)	40 (dual 1×20)	96 (dual 1×48)	60 (dual 1×30) or 120 single pole (dual 1×60)	60 (dual 1×30)	6×16	6×16	448 cross-points (Quad 4×28)	32	40 digital I/O, 4 count-er/totalizers, and 2 iso-lated analog outputs
Card Config.	Multiplexer	Multiplexer	Multiplexer	Multiplexer	Multiplexer	Matrix	Matrix	Matrix	Independent	Independent
Type of Relay	Latching electro-mechanical	Latching electro-mechanical	Latching electro-mechanical	Dry reed	FET solid-state	Latching electro-mechanical	Dry reed	Dry reed	Latching electro-mechanical	N/A
Contact Configuration	2 Form A	2 Form A	2 Form A	1 Form A	2 Form A	2 Form A	2 Form A	1 Form A	28 Form C, 4 Form A	N/A
Max. Voltage	300 V	300 V (ch 1–40), 60 V (ch 41–42)	300 V	200 V	200 V	300 V	200 V	200 V	300 VDC /250 VAC (Form A)	N/A
Max. Current Switched	1 A	2 A (ch 1–40), 3 A (ch 41–42)	1 A	1 A	0.1 A	1 A	1 A	0.75 A	2 A (Form C), 7 A (Form A)	N/A
Comments	2 indepen-dent 1×30 multiplexers. Automatic temperature reference when used with screw terminal accessory (3720-ST)	2 indepen-dent 1×20 multiplexers. Automatic temperature reference when used with screw terminal accessory (3721-ST)	2 indepen-dent 1×48 multiplexers	2 indepen-dent 1×30 multiplexers	2 indepen-dent 1×30 multiplexers. Automatic temperature reference when used with screw terminal accessory (3724-ST)	Columns can be expanded through the backplane or isolated by relays	Relay actu-ation time of 0.5ms. Columns can be expanded through the backplane or isolated by relays	Banks can be connected together via bank config-uration relays to create a single 4×112 or dual 4×56 matrix. Ana-log backplane relays also included for card to card expansion. Row expan-sion with 3732-ST-R accessory to create a dual 8×28 or single 16×28 matrix.	32 general purpose independent channels.	All-in-one card design. 40 bidirec-tional I/O. Four 32-bit counter/ totalizers. 2 programma-ble analog (V or I) outputs.

DMM Comparison Table

MODEL	BASIC PERFORMANCE			HIGH SPEED, HIGH ACCURACY		
	2110	**2100**	**DMM6500**	**DMM7510**	**DMM7512**	**2010**
Display	LCD 2 line	VFD 2 line	Touchscreen, 5 in. (12.7 cm)	Touchscreen, 5 in. (12.7 cm)	None	VFD
Digits	5½	6½	6½	7½	7½	7½
No. Measurement Channels	1	1	10	1	2	10
DC VOLTS						
Measurement Range	1 µV–1000 V	0.1 µV–1000 V	100 nV–1000 V	10 nV–1010 V	10 nV–1010 V	10 nV–1000 V
Basic Accuracy	0.012%	0.0038%	0.0025%	0.0014%	0.0014%	0.0024%
Ratio		✔	✔	✔	✔	✔
DC Peak Spikes						
AC VOLTS (TRMS)						
Measurement Range	1 µV–750 V	0.1 µV–750 V	100 nV–750 V	100 nV–707 V		100 nV–750 V
Basic Accuracy	0.12%	0.08%	0.05%	0.06%		0.05%
Bandwidth	10 Hz–300 kHz	3 Hz–300 kHz	3 Hz–300 kHz	3 Hz to 300 kHz		3 Hz–300 kHz
dB, dBm		✔	✔	✔		✔
Frequency, Period	✔	✔	✔	✔		✔
OHMS (2/4 WIRE)						
Measurement Range	1 mΩ–100 MΩ	100 µΩ–100 MΩ	1 µΩ–120 MΩ	0.1 µΩ–1.2 GΩ	0.1 µΩ–1.2 GΩ	1 µΩ–120 MΩ
Basic Accuracy	0.02%	0.015%	0.0075%	0.0024%	0.0024%	0.0032%
Continuity Test	✔	✔	✔	✔	✔	✔
Diode Test	✔	✔	✔	✔	✔	✔
Offset Compensation			✔	✔	✔	✔
Dry Circuit				✔	✔	✔
DC AMPS						
Measurement Range	0.1 µA–10 A	10 nA–3 A	10 pA–10 A	1pA–10.1 A	1 pA–3 A	1 nA–3 A
Basic Accuracy	0.15%	0.055%	0.02%	0.006%	0.006%	0.03%
In Circuit Current						
AC AMPS (TRMS)						
Measurement Range	10 µA–10 A	1 µA–3 A	100 pA–10 A	1 nA–10.1 A		1 µA–3 A
Basic Accuracy	0.3%	0.15%	0.1%	0.08%		0.1%
Bandwidth	10 Hz–5 kHz	3 Hz–5 kHz	3 Hz–10 kHz	3 Hz to 10 kHz		3 Hz–5 kHz
OTHER MEASUREMENTS						
Capacitance			0.1 pF–100 µF	0.1 pF–100 µF		
Temperature Measurement	TC, RTD, Thermistor	RTD	TC, RTD, Thermistor	TC, RTD, Thermistor	TC, RTD, Thermistor	TC, RTD
GENERAL FEATURES						
Interface	USB, GPIB (opt.)	USB	LAN/LXI, USB, GPIB (opt.), RS-232 (opt.)	GPIB, USB, LAN/LXI	USB, LAN/LXI	GPIB, RS-232
Reading Hold	✔	✔				✔
Digital I/O	Trigger In Meter Complete	Trigger In Meter Complete	Trigger In Meter Complete	Trigger In Meter Complete 6 General I/O	Trigger In Meter Complete 6 General I/O	Trigger In Meter Complete
Reading Memory	2000 rdg.	2000 rdg.	7 M rdg.	27.5 M rdg.	27.5 M rdg./channel	1024 rdg.
Maximum Speed	50K rdg/s	2000 rdg/s	1 M rdg/s (16-bit digitizing)	1 M rdg/s (18-bit digitizing)	1 M rdg/s (18-bit digitizing)	2000 rdg/s
Other			Embedded Test Script Processor and optional TSP-Link, 6 Digital I/O with Interface Options, Dual Measurement Display	Embedded Test Script Processsor and TSP-LINK	Embedded Test Script Processsor and TSP-LINK, 2 Digitizers	

To learn more about our basic performance, high speed, and high accuracy digital multimeters, visit www.tek.com/digital-multimeter.
To learn more about our multi-channel measurement digital multimeters, visit www.tek.com/keithley-switching-and-data-acquisition-systems.

HIGH ACCURACY		MULTI-CHANNEL MEASUREMENT			
2001	**2002**	**DAQ6510**	**2750**	**3706A**	**MODEL**
VFD	VFD	Touchscreen, 5 in. (12.7 cm)	VFD	VFD 2 line	**Display**
7½	8½	6½	6½	7½	**Digits**
10	10	80	200	576	**No. Measurement Channels**
					DC VOLTS
10 nV–1100 V	1 nV–1100 V	100 nV–1000 V	100 nV–1000 V	10 nV–300 V	**Measurement Range**
0.0024%	0.001%	0.0025%	0.003%	0.0025%	**Basic Accuracy**
Option	Option	w/MUX card	w/MUX card		**Ratio**
✔	✔				**DC Peak Spikes**
					AC VOLTS (TRMS)
100 nV–775 V	100 nV–775 V	100 nV–750 V	100 nV–750 V	100 nV–300 V	**Measurement Range**
0.03%	0.02%	0.05%	0.06%	0.05%	**Basic Accuracy**
1 Hz–2 MHz	1 Hz–2 MHz	3 Hz–300 kHz	3 Hz–300 kHz	3 Hz–300 kHz	**Bandwidth**
✔	✔			✔	**dB, dBm**
✔	✔	✔	✔	✔	**Frequency, Period**
					OHMS (2/4 WIRE)
1 μΩ–1 GΩ	100 nΩ–1 GΩ	1 μΩ–120 MΩ	1 μΩ–120 MΩ	100 nΩ–100 MΩ	**Measurement Range**
0.0032%	0.0007%	0.0075%	0.008%	0.004%	**Basic Accuracy**
		✔	✔	✔	**Continuity Test**
		✔			**Diode Test**
✔	✔	✔	✔	✔	**Offset Compensation**
			✔	✔	**Dry Circuit**
					DC AMPS
10 pA–2 A	10 pA–2 A	10 pA–3 A	10 nA–3 A	1 pA–3 A	**Measurement Range**
0.03%	0.027%	0.02%	0.03%	0.03%	**Basic Accuracy**
✔	✔				**In Circuit Current**
					AC AMPS (TRMS)
100 pA–2 A	100 pA–2 A	100 pA–3 A	1 μA–3 A	1 nA–3 A	**Measurement Range**
0.1%	0.1%	0.10%	0.15%	0.08%	**Basic Accuracy**
20 Hz–100 kHz	20 Hz–100 kHz	3 Hz–10 kHz	3 Hz–5 kHz	3 Hz–10 kHz	**Bandwidth**
					OTHER MEASUREMENTS
		0.1 pF–100 μF			**Capacitance**
TC, RTD	TC, RTD	TC, RTD, Thermistor	TC, RTD, Thermistor	TC, RTD, Thermistor	**Temperature Measurement**
					GENERAL FEATURES
GPIB	GPIB	LAN/LXI, USB, GPIB (opt.), RS-232 (opt.)	GPIB, RS-232	GPIB, LAN/LXI, USB	**Interface**
					Reading Hold
Trigger In Meter Complete 1 In, 4 Out	Trigger In Meter Complete 1 In, 4 Out	Trigger In Meter Complete	2 Trigger In, 5 Limit Out	14 General I/O	**Digital I/O**
Opt to 30,000	Opt to 30,000	7 M rdg.	110,000 rdg.	650,000 rdg.	**Reading Memory**
2000 rdg/s	2000 r dg/s	1 M rdg/s (16-bit digitizing)	2500 rdg/s	>14,000 rdg/s	**Maximum Speed**
		Embedded Test Script Processor and optional TSP-Link, 6 Digital I/O with Interface Options		Embedded Test Script Processsor and TSP-LINK	