Datasheet

DMM7512 Dual Channel 7½-Digit Sampling Multimeter



KEITHLEY
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Key Features

- Two high-precision, 7½-digit DMMs in a 1U high, full rack width chassis
- No space requirements between instruments minimizes rack space
- Capture waveforms or identify transients with two 1 Msample/s 18-bit digitizers
- Trigger a waveform measurement on a signal level, a rising or falling edge, a window, or a digital trigger
- Store up to 27.5M timestamped readings on a waveform
- Basic one-year DC Voltage accuracy as low as 14 ppm
- 10 nV, 0.1 µΩ, and 1 pA sensitivities for making high resolution low level measurements such as measurements of portable device sleep currents
- High accuracy, low resistance measurements with offset compensated ohms, four-wire measurement, and dry circuit functions
- Auto-calibration improves accuracy and stability by minimizing temperature and time drift
- USBTMC-compliant and LAN LXI-compliant interfaces
- Reduce test time by executing test scripts with the Embedded Test Script Processor, which saves PC command communication overhead
- Tight synchronization between the two DMMs using TSP-Link® communication
- Reduce life cycle costs with a two-year calibration interval

The DMM7512 Dual Channel 7½-digit Sampling Multimeter combines two full-function, high accuracy and high sampling speed DMMs into a compact 1U high, full rack wide form factor chassis. The compact chassis saves rack space in high-instrument density, test systems. The small size does not compromise measurement performance. Each DMM has identical functionality, and both are entirely independent of each other. The DMMs achieve a basic, one-year accuracy as low as 14 ppm for DC volts, 24 ppm for resistance, and 60 ppm for DC current. Sensitivities of 10 nV, 0.1 µΩ, and 1 pA ensure high quality, high resolution measurements on very small signals. In addition, each DMM has a wide range of functionality including voltage digitizing, current digitizing, and temperature measurements with resistance temperature detectors (RTDs), thermistors, and thermocouples. With dual channel capability, fast signal sampling, high speed data transfer rates reaching up to 100,000 measurements/s, and internal execution of program test scripts, the DMM7512 reduces space and reduces test time in automated test systems.

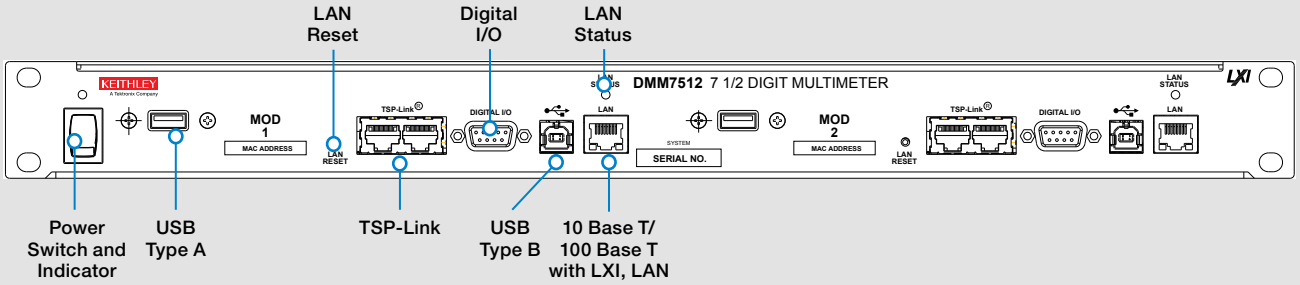
Capture Low Level Waveforms with the 1 Msample/s Digitizer

Avoid the need for a separate instrument to capture waveform parameters or ensure a waveform is within design limits by using the digitizing function. Digitize either voltage or current and sample a waveform at a rate of up to 1 Msamples/s with the 18-bit digitizer. The digitizing function employs the same ranges that the DC voltage and DC current functions use to deliver exceptional dynamic measurement range. With the digitizer's 1 µV and 0.1 nA sensitivities, the DMM7512 is the best solution for measuring low level waveforms such as wireless IoT battery current profiles and laser diode current consumption profiles. Using the digitizing function, the two DMMs can measure the current in all the operating states of a device including the sleep state and the current burst state when the device is transmitting. By using the two DMMs as synchronized digitizers, one for voltage and one for current, power can be accurately computed on time-varying waveforms.

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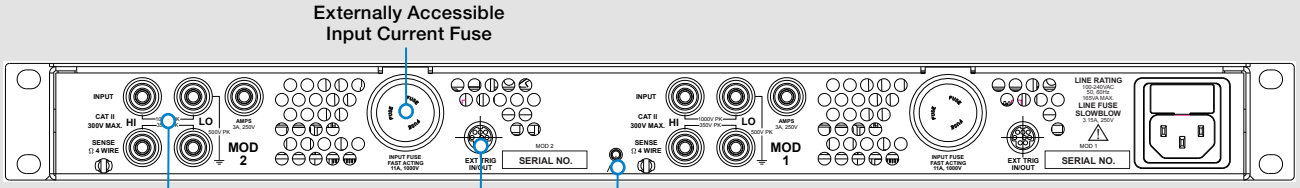
DMM7512 Front Panel

Shows the two DMM's multiple, communication interfaces.



DMM7512 Rear Panel

Shows the identical measurement inputs for DMM 1 and DMM 2.



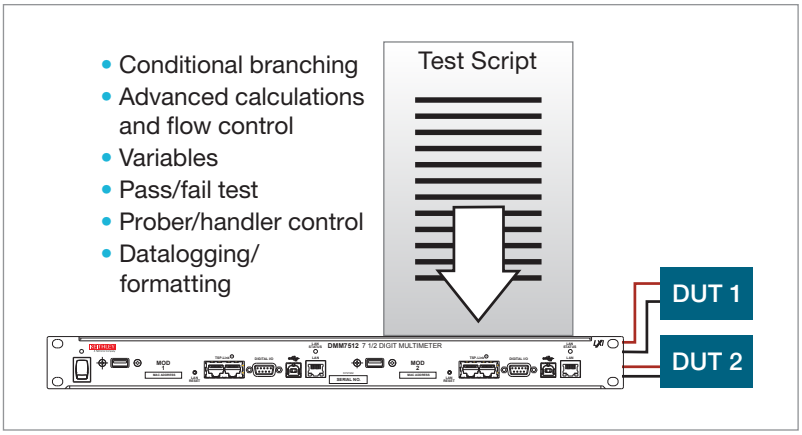
The digitizers can trigger on either the slope, a level, or a window of an input waveform. The digitizers can also trigger on digital control signals such as external, hardware trigger inputs and software trigger commands. Each digitizer function provides oscilloscope-like performance with excellent sensitivity, high resolution, and a fast sampling rate.

Optimized to Maximize Throughput

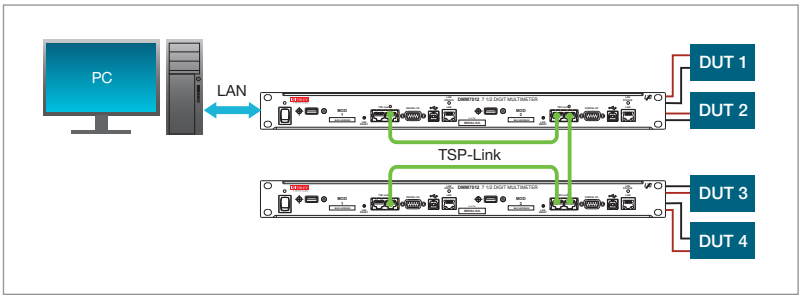
In addition to the high-speed sampling and fast integrating measurement modes, each of the DMM7512's DMMs utilize Keithley's powerful Test Script Processor (TSP®) technology. This embedded scripting capability enables each DMM to run powerful test scripts directly on the instrument without external PC interaction. These test scripts are complete test programs based on an easy-to-use, yet highly efficient and compact scripting language, Lua (www.lua.org). Scripts include instrument control commands and program statements. Program statements control script execution and include typical programming language features such as variables, functions, branching, and loop control. A test script can execute a complete test including performing specialized computations and making decisions on results without having to receive and decode individual commands from a controller. This saves significant test time by eliminating a substantial amount of interface communication time.

TSP technology also offers instrument-to-instrument communication and control through the TSP-Link® channel expansion bus. The DMMs in the DMM7512 can communicate with each other and with other TSP-enabled instruments, such as the 4-channel 2606B System SourceMeter® Source Measure Unit (SMU) Instrument, in a master-subordinate configuration so that all instruments operate as a single, integrated system controlled by a TSP script in the master instrument. TSP-Link supports up to 32 instruments per IP address, so a system can be easily scaled for any test system requirements.

In addition to communicating with and controlling TSP-enabled instruments, any instrument with a LAN interface can be controlled by a TSP-embedded test script using the TSP-Net communication facility.



Embedded TSP test scripts execute complete test programs and reduce test time.



A test script can control multiple instruments through the TSP-Link interface. Measurements between all DMMs can be synchronized with a latency of under 500 ns.



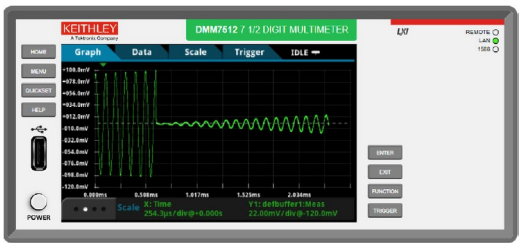
Simultaneously stimulate and measure multiple DUTs with the compact, high density, configuration of the dual-DMM DMM7512 and the four-channel 2606B System SourceMeter SMU Instrument.

Use the Virtual Front Panel for Test Setup or Manual Measurements

Even though the DMM7512 does not have a front panel display, the instrument has a built-in web browser with a virtual front panel. Through a LAN interface connection, the virtual front panel can be displayed on a PC monitor. With the virtual front panel, each DMM of the DMM7512 can be controlled using either the PC touchscreen display or mouse and keyboard controls. All the functionality of each DMM can be accessed through the virtual front panel. Thus manual operation and test setup can be performed as easily as if the instrument had a physical front panel.



The DMM7512 virtual front panel displays a conventional DMM front panel.



Use the virtual front panel to obtain a full screen display of a waveform. Apply cursors and statistics for waveform analysis.

Specification Conditions

This document contains specifications and supplemental information for the DMM7512 7½ Digit Graphical Sampling Multimeter instrument. Specifications are the standards against which the DMM7512 is tested. Upon leaving the factory, the DMM7512 meets these specifications. Supplemental and typical values are nonwarranted, apply at 23 °C, and are provided solely as useful information. Measurement accuracies are specified at the DMM7512 terminals under these conditions:

- Temperature 23 °C ±5 °C, 5% to 80 60% relative humidity, noncondensing
- After a 4-hour warmup period
- 1 PLC or 5 PLC; for NPLC settings less than 1 PLC, add appropriate ppm of range for peak noise uncertainty from the RMS noise table
- Autozero enabled unless otherwise noted
- Remote sense operation or properly zeroed local operation
- Calibration period: One year or two years (calibration period may vary depending on customer requirements)
- T_{ACAL} = Ambient temperature of last automatic calibration
- T_{CAL} = Ambient temperature of last external calibration; factory calibration performed at 23 °C ±1 °C

DC Voltage

Accuracy (Input impedance auto)

Range[1]	Resolution	Input Impedance	Accuracy ±(ppm of reading + ppm of range)				
			24 hour T_{CAL} ±1 °C[2]	90 day T_{CAL} ±5 °C	1 year T_{CAL} ±5 °C	2 year T_{CAL} ±5 °C	Temperature Coefficient[3]
100.00000 mV[4]	10 nV	> 10 GΩ or 10 MΩ ±1%	6 + 30	12 + 30	18 + 30	29 + 30	0.1 + 2.5
1.0000000 V[4]	100 nV	> 10 GΩ or 10 MΩ ±1%	4 + 2	9 + 5	15 + 5	26 + 5	0.1 + 0.5
10.000000 V[4]	1 µV	> 10 GΩ or 10 MΩ ±1%	2 + 0.7	9 + 1.2	14 + 1.2	22 + 1.2	0.1 + 0.05
100.00000 V[4]	10 µV	10 MΩ ±1%	8 + 6	(18 + 15)[5]	(22 + 15)[5]	(30 + 15)[5]	(0.15 + 0.1)[5]
				35 + 15	40 + 15	45 + 15	2.0 + 1
1000.0000 V[4, 6]	100 µV	10 MΩ ±1%	8 + 6	(19 + 10)[5]	(23 + 10)[5]	(31 + 10)[5]	(0.15 + 0.1)[5]
				35 + 10	40 + 10	45 + 8	2.0 + 1

NOTES

1. 20% overrange on all ranges except 1% for 1000 V range.
2. Relative to calibration accuracy.
3. Add per degree from T_{CAL} ± 5 °C.
4. When properly zeroed using the Rel function with external cables.
5. Specified within 30 days of autocalibration, T_{OPER} ± 5 °C from T_{ACAL}.
6. For signal levels greater than 500 V, add 0.02 ppm/V to the ppm of the readings specification for measurements exceeding 500 V.

RMS NOISE (ADDITIONAL PEAK NOISE UNCERTAINTY) [7]

Applies to ±ppm of range.

Peak noise uncertainty is included in DC specifications for ≥1 PLC.

Add peak noise uncertainty to measurements for <1 PLC.

Input impedance set to auto.

Examples

10 V at 0.006 PLC: 1.2 (from Accuracy table) + 11 (additional peak noise uncertainty) = 12.2 ppm of range.

10 V at 1 PLC: 1.2 + 0 = 1.2 ppm of range.

NPLC	Digits	100 mV	1 V	10 V	100 V	1000 V
5	7½	0.5	0.08	0.06	0.3	0.06
1	7½	0.5	0.09	0.07	0.4	0.07
0.2 [8]	6½	2 (10)	0.2 (1.6)	0.1 (1.1)	1.1 (9.4)	0.1 (1)
0.2	6½	2 (12)	0.2 (1.6)	0.1 (1)	1.1 (8.9)	0.2 (1.1)
0.06	5½	3 (17)	0.4 (2.7)	0.3 (2.1)	3 (17)	0.3 (2.4)
0.006	4½	19 (95)	3 (18)	3 (15)	34 (125)	3 (18)
0.0005	3½	95 (480)	48 (215)	36 (170)	173 (800)	40 (205)

DC Voltage Characteristics

ADC Linearity	1.0 ppm of reading + 1.0 ppm of range
Input Impedance	**100 mV to 10 V Ranges:** Selectable >10 GΩ ‖ <400 pF (auto) or 10 MΩ ±1% (10 MΩ) **100 V to 1000 V Ranges:** 10 MΩ ±1%
Input Bias Current	<50 pA at 23 °C under the following conditions: Autozero off or input impedance 10 MΩ
Common Mode Current	<2.1 µA peak-peak in 1 MHz bandwidth <100 nA peak-peak in 1 kHz bandwidth
Common Mode Voltage	500 V_{PEAK} LO terminal to chassis maximum
DC Voltage Autozero Off Error	For ±1 °C and ≤10 minutes, add ±(8 ppm of reading + 15 µV)

Normal Mode Rejection

For DC voltage, line frequency ±0.1%

	5 PLC	1 PLC	≤0.2 PLC	≤0.01 PLC
Line Sync On	110 dB	90 dB	45 dB	—
Line Sync Off	60 dB	60 dB	—	—

Common Mode Rejection

For DC voltage and 100 Ω unbalanced in LO terminal

NPLC	5	1	0.2	≤ 0.2
Line Sync	On	On	On	Off
CMRR	140 dB	140 dB	120 dB	80 dB

NOTES

7. Noise values are based on 1000 readings with autozero on and using low thermal 4-wire short. VRMS noise is typical. Additional peak noise is guaranteed.
8. With line sync on.

Resistance

Enhanced Accuracy (within 30 days of autocalibration, T_{OPER} ± 5 °C from T_{ACAL}) [9]

Range [10]	Resolution	Test Current [11] (±5%)	Accuracy ±[ppm of reading + ppm of range]				
			24 Hour T_{CAL} ±1 °C [12]	90 Day T_{CAL} ±5 °C	1 Year T_{CAL} ±5 °C	2 Year T_{CAL} ±5 °C	Temperature Coefficient [13]
1.0000000 Ω	0.1 µΩ	10 mA	15 + 60	30 + 60	30 + 60	30 + 60	0.15 + 0.1
10.000000 Ω	1 µΩ	10 mA	15 + 6	30 + 6	30 + 6	30 + 6	0.15 + 0.1
100.00000 Ω	10 µΩ	1 mA	12 + 4	27 + 4	27 + 4	27 + 4	0.15 + 0.1
1.0000000 kΩ	100 µΩ	1 mA	12 + 3	24 + 3	24 + 3	24 + 3	0.15 + 0.1
10.000000 kΩ [14]	1 mΩ	100 µA	13 + 3	30 + 3	30 + 3	30 + 3	0.15 + 0.1
100.00000 kΩ [14, 15]	10 mΩ	10 µA	13 + 3	30 + 3	30 + 3	30 + 3	0.3 + 0.1
1.0000000 MΩ [14, 16]	100 mΩ	10 µA	14 + 3	30 + 4	30 + 4	30 + 4	0.7 + 0.1
10.000000 MΩ [17]	1 Ω	0.69 µA ‖ 10 MΩ	150 + 6	200 + 10	200 + 10	200 + 10	70 + 1
100.00000 MΩ [17]	10 Ω	0.69 µA ‖ 10 MΩ	800 + 30	2000 + 30	2000 + 30	2000 + 30	385 + 1
1.0000000 GΩ [17]	100 Ω	0.69 µA ‖ 10 MΩ	9000 + 100	9000 + 100	9000 + 100	9000 + 100	3000 + 1

Accuracy [18]

Range [19]	Resolution	Test Current [20] (±5%)	Accuracy ±(ppm of reading + ppm of range)				
			24 Hour T_{CAL} ±1 °C [21]	90 Day T_{CAL} ±5 °C	1 Year T_{CAL} ±5 °C	2 Year T_{CAL} ±5 °C	Temperature Coefficient [22]
1 Ω	0.1 µΩ	10 mA	15 + 60	40 + 60	50 + 60	70 + 60	2.5 + 5
10 Ω	1 µΩ	10 mA	15 + 6	40 + 6	50 + 6	70 + 6	2.5 + 0.5
100 Ω	10 µΩ	1 mA	12 + 4	35 + 4	47 + 4	65 + 4	5 + 0.25
1 kΩ	100 µΩ	1 mA	12 + 3	30 + 3	41 + 3	65 + 3	5 + 0.25
10 kΩ [23]	1 mΩ	100 µA	10 + 3	30 + 3	42 + 3	65 + 3	2.5 + 0.25
100 kΩ [23, 24]	10 mΩ	10 µA	13 + 3	38 + 3	50 + 3	65 + 3	5 + 1
1 MΩ [23, 25]	100 mΩ	10 µA	14 + 3	38 + 5	50 + 5	65 + 5	5 + 1
10 MΩ [26]	1 Ω	0.69 µA ‖ 10 MΩ	150 + 6	200 + 10	400 + 10	600 + 12	70 + 1
100 MΩ [26]	10 Ω	0.69 µA ‖ 10 MΩ	800 + 30	2000 + 30	2000 + 30	2600 + 30	385 + 1
1 GΩ [26]	100 Ω	0.69 µA ‖ 10 MΩ	9000 + 200	9000 + 200	13000 + 200	14000 + 200	3000 + 1

NOTES

9. Specifications are for 4-wire resistance, offset compensation on for ≤10 kΩ measurements, and offset compensation off for ≥10 kΩ measurements. 1 Ω range is 4-wire only. For 2-wire, with Rel, add 50 mΩ to ppm of range uncertainty. Without Rel and with Model 1756 test leads, add 100 mΩ to ppm of range uncertainty.
10. 20% overrange on all ranges.
11. Test current with offset compensation off.
12. Relative to calibration accuracy.
13. Add per degree from T_{CAL} ±5 °C.
14. Specifications are for external cable and load capacitance <1 nF.
15. For offset compensation on, add 10 ppm uncertainty to ppm of reading.
16. For 4-wire 1 MΩ, open lead detector on, add 10 ppm uncertainty to ppm of reading.
17. Specified for <10% lead resistance mismatch in HI and LO.
18. Specifications are for 4-wire resistance, offset compensation on for ≤10 kΩ measurements, and offset compensation off for ≥10 kΩ measurements. 1 Ω range is 4-wire only. For 2-wire, with Rel, add 50 mΩ to ppm of range uncertainty. Without Rel and with Model 1756 test leads, add 100 mΩ to ppm of range uncertainty.
19. 20% overrange on all ranges.
20. Test current with offset compensation off.
21. Relative to calibration accuracy.
22. Add per degree from T_{CAL} ±5 °C.
23. Specifications are for external cable and load capacitance < 1 nF.
24. For offset compensation on, add 10 ppm of uncertainty to ppm of reading.
25. For 4-wire, 1 MΩ, open lead detection on, add 10 ppm uncertainty to ppm of reading.
26. Specified for <10% lead resistance mismatch in HI and LO.

Resistance Open Circuit DC Voltage [27]

Range [19]	2-wire	Offset Compensation Off	Offset Compensation On
		4-wire	4-wire
1 Ω	–	9.2 V	9.5 V
10 Ω	9.2 V	9.2 V	9.5 V
100 Ω, 1 kΩ	14.0 V	14.2 V	14.3 V
10 kΩ	9.5 V	9.5 V	9.5 V
100 kΩ, 1 MΩ	12.7 V	14.3 V	14.3 V (100 kΩ range only)
10 MΩ to 1 GΩ	6.9 V	6.9 V	–

4-Wire Ohms (≤10kΩ) Offset Compensation On

RMS Noise (additional peak noise uncertainty) [28]

Applies to ± ppm of range.

Peak noise uncertainty is included in DC specifications for ≥1 PLC.

Add peak noise uncertainty to measurements for <1 PLC.

Examples

1 kΩ at 0.006 PLC: 3 (from Accuracy table) + 26 (additional peak noise uncertainty) = 29 ppm of range.

1 kΩ at 1 PLC: 3 + 0 = 3 ppm of range.

NPLC	Digits	1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ
5	7½	2.8	0.3	0.3	0.07	0.3
1	7½	4.2	0.4	0.4	0.12	0.5 (2)
0.2 [29]	6½	30 (160)	3 (13)	3 (13)	0.4 (2.6)	1.2 (8.2)
0.2	6½	50 (250)	5 (22)	5 (22)	0.6 (3.2)	1.2 (8.3)
0.06	5½	115 (546)	11 (54)	12 (56)	1.1 (6.6)	3 (18)
0.006	4½	397 (2144)	40 (215)	38 (216)	6 (34)	15 (78)
0.0005	3½	1767 (9333)	177 (933)	183 (954)	85 (406)	89 (456)

2-Wire Ohms

RMS Noise (additional peak noise uncertainty) [28]

Applies to ±ppm of range.

Peak noise uncertainty is included in DC specifications for ≥1 PLC.

Add peak noise uncertainty to measurements for <1 PLC.

Examples

10 kΩ at 0.006 PLC: 3 (from Accuracy table) + 5 (50 mΩ with Rel) + 43 (additional peak noise uncertainty) = 51 ppm of range.

10 kΩ at 1 PLC: 3 + 5 + 0 = 8 ppm of range.

NPLC	Digits	10 Ω	100 Ω	1 kΩ	10 kΩ
5	7½	1.1	0.8 (0.4)	0.1	0.2
1	7½	0.6	0.6 (0.4)	0.09	0.4 (0.45)
0.2 [29]	6½	2 (17)	2 (10)	0.2 (1.5)	0.8 (6.3)
0.2	6½	2 (17)	2 (14)	0.3 (1.6)	0.8 (6.4)
0.06	5½	5 (29)	6 (32)	0.4 (3.7)	2 (12)
0.006	4½	25 (114)	21 (119)	3 (21)	9 (50)
0.0005	3½	103 (517)	109 (536)	56 (219)	55 (283)

NOTES

27. Open circuit voltage is typical, measured from input HI to LO, SHI and SLO open. For 1 Ω to 1 MΩ ranges using an external digital multimeter (DMM) set to 10 MΩ input impedance; for 10 MΩ to 1 GΩ ranges, set external DMM to >10 GΩ input impedance.
28. Noise values are based on 1000 readings with autozero on and using low thermal 4-wire short. RMS noise is typical. Additional peak noise is guaranteed.
29. With line sync on.

Resistance Characteristics

Maximum 4-Wire Ohms Lead Resistance	5 Ω per lead for 1 Ω range, 10% of range per lead for 10 Ω to 1 kΩ ranges; 1 kΩ per lead for all other ranges.
Offset Compensation	Selectable on 4-wire, 1 Ω to 100 kΩ ranges.
Open Lead Detector	Default is off.
Autozero Off Error	For 2-wire ohms, ±1 °C and ≤10 minutes, add ±(8 ppm of reading) + 1.5 mΩ for 10 Ω range, 15 mΩ for 100 Ω and 1 kΩ ranges, 150 mΩ for 10 kΩ range, 1.5 Ω for 100 kΩ range, and 15 Ω for all other ranges. For 4-wire ohms, ±1 °C and ≤10 minutes, add ±(8 ppm of reading).
Input Current Limit	For signals with a magnitude of +12 V to +40 V or –12 V to –40 V: ±13 mA source or sink, typical. For signals with a magnitude of greater than +40 V or –40 V: ±130 µA source or sink, typical.

DC Current

Enhanced Accuracy (within 30 days of autocalibration, T_{OPER} ±5 °C from T_{ACAL})

Range[30]	Resolution	Maximum Burden Voltage	Accuracy ±(ppm of reading + ppm of range)				
			24 Hour T_{CAL} ±1 °C[31]	90 Day T_{CAL} ±5 °C	1 Year T_{CAL} ±5 °C	2 Year T_{CAL} ±5 °C	Temperature Coefficient[32]
10.000000 µA	1 pA	15 mV	30 + 30	75 + 30	75 + 30	75 + 30	0.15 + 0.1
100.00000 µA	10 pA	15 mV	20 + 5	60 + 9	60 + 9	60 + 9	0.15 + 0.1
1.0000000 mA	100 pA	15 mV	30 + 5	60 + 9	60 + 9	60 + 9	0.15 + 0.1
10.000000 mA	1 nA	20 mV	40 + 5	60 + 9	60 + 9	60 + 9	0.15 + 0.1
100.00000 mA	10 nA	200 mV	50 + 18	150 + 30	150 + 30	150 + 30	0.15 + 0.1
1.0000000 A	100 nA	400 mV	150 + 50	400 + 50	400 + 50	400 + 50	0.15 + 0.1
3.000000 A	1 µA	1300 mV	200 + 40	400 + 40	400 + 40	400 + 40	0.15 + 0.1

Accuracy

Range[30]	Resolution	Maximum Burden Voltage	Accuracy ±(ppm of reading + ppm of range)				
			24 Hour T_{CAL} ±1 °C[31]	90 Day T_{CAL} ±5 °C	1 Year T_{CAL} ±5 °C	2 Year T_{CAL} ±5 °C	Temperature Coefficient[32]
10.000000 µA	1 pA	15 mV	30 + 30	100 + 30	125 + 40	175 + 50	10 + 8
100.00000 µA	10 pA	15 mV	20 + 5	75 + 12	100 + 15	150 + 20	10 + 3
1.0000000 mA	100 pA	15 mV	30 + 5	75 + 12	100 + 15	150 + 20	10 + 3
10.000000 mA	1 nA	20 mV	40 + 5	75 + 12	100 + 15	150 + 20	10 + 3
100.00000 mA	10 nA	200 mV	50 + 18	300 + 30	400 + 30	500 + 30	50 + 5
1.0000000 A	100 nA	400 mV	150 + 50	400 + 50	450 + 50	500 + 50	10 + 10
3.000000 A	1 µA	1300 mV	200 + 40	400 + 40	450 + 40	500 + 40	10 + 10

NOTES

30. 20% overrange supported for all ranges except for 3 A, which is 1% supported.
31. Relative to calibration accuracy.
32. Add per degree from T_{CAL} ±5 °C.

RMS Noise (additional peak noise uncertainty) [33]	
	Applies to ± ppm of range.
	Peak noise uncertainty is included in DC specifications for ≥1 PLC.
	Add peak noise uncertainty to measurements when <1 PLC.
Examples	1 mA at 0.006 PLC: 9 (from Accuracy table) + 20 (additional peak noise uncertainty) = 29 ppm of range.
	1 mA at 1 PLC: 9 +0 = 9 ppm of range.

NPLC	Digits	10 µA	100 µA	1 mA	10 mA	100 mA	1A	3A
5	7½	0.15	0.14	0.09	0.1	0.3	0.3	0.2
1	7½	0.4	0.13	0.1	0.1	0.5	0.5	0.3
0.2	6½	0 (220)	0 (23)	0.2 (3.4)	0.2 (1.6)	2 (10)	2 (11)	0.7 (4.6)
0.2 [34]	6½	120 (260)	12 (26)	1.2 (3.8)	0.3 (1.8)	1.9 (9.8)	2 (10)	0.8 (5)
0.06	5½	130 (280)	12 (29)	1.3 (5.6)	0.4 (3.9)	2 (14)	2 (14)	1.2 (7.7)
0.006	4½	130 (350)	14 (42)	3 (20)	2 (20)	4 (30)	4 (31)	7 (51)
0.0005	3½	260 (2110)	30 (300)	20 (150)	20 (160)	30 (190)	30 (190)	70 (510)

DC Current Characteristics

Range	10 µA	100 µA	1 mA	10 mA	100 mA	1 A	3 A
Effective Internal Shunt Value [35]	1 kΩ	100 Ω	10 Ω	1 Ω	0.1 Ω	0.1 Ω	0.1 Ω
Autozero Off Error: For ±1 °C and ≤10 minutes add ±(8 ppm of reading + range error)	150 pA	1.5 nA	15 nA	150 nA	15 µA	150 µA	150 µA
Overload Recovery: For each additional sustained amp beyond ±1.5 A, add the following initial ppm of range error until thermally settled after overload recovery	15500	1800	150	150	6500	200	—

Temperature

4-Wire RTD or 3-Wire RTD

Types: 100 Ω platinum PT100, D100, F100, PT385, PT3916; or user-configurable 0 Ω to 10 kΩ.

Type	Range	Resolution	Accuracy ± °C	
			2 Year, T_{CAL} ±5 °C	Temperature Coefficient [36]
4-Wire RTD	–200° to 400 °C	0.01 °C	0.09 °C	0.003 °C/ °C
3-Wire RTD [37]	–200° to 400 °C	0.01 °C	0.75 °C	0.003 °C/ °C

Thermistor

Types: 2.252 kΩ, 5 kΩ, and 10 kΩ.

Type	Range	Resolution	Accuracy ± °C	
			2 Year, T_{CAL} ±5 °C	Temperature Coefficient [36]
Thermistor	–80° to +150 °C	0.01 °C	0.08 °C	0.002 °C/ °C

NOTES

33. Noise values are based on 1000 readings with autozero on and AMPS terminal open. RMS noise is typical. Additional peak noise is guaranteed.
34. With line sync on.
35. Values are typical and guaranteed by design.
36. Add per degree from T_{CAL} ±5 °C; specifications without autocalibration.
37. For 3-wire RTD, accuracy is for < 0.1 Ω lead resistance mismatch for input HI and LO. Add 0.25 °C/ 0.1 Ω of HI-LO lead resistance mismatch.

Thermocouple

Types: B, E, J, K, N, R, S, T

			Accuracy ± °C	
Type	Range	Resolution	2 Year, T_{CAL} ±5 °C[38] Simulated Reference Junction	Temperature Coefficient[36]
B	350 to +1820 °C	0.1 °C	0.9 °C	0.03 °C/ °C
E	–200 to +1000 °C	0.001 °C	0.4 °C	0.03 °C/ °C
J	–200 to +760 °C	0.001 °C	0.4 °C	0.03 °C/ °C
K	–200 to +1372 °C	0.001 °C	0.4 °C	0.03 °C/ °C
N	–200 to +1300 °C	0.001 °C	0.4 °C	0.03 °C/ °C
R	0 to +1768 °C	0.1 °C	0.9 °C	0.03 °C/ °C
S	0 to +1768 °C	0.1 °C	0.9 °C	0.03 °C/ °C
T	–100 to +400 °C	0.001 °C	0.4 °C	0.03 °C/ °C

Continuity

				Accuracy ±(ppm of reading + ppm of range)	
Range[39]	Resolution	Test Current	Open Circuit Voltage	2 Year, T_{CAL} ±5 °C	Temperature Coefficient[40]
1.0000 kΩ	100 mΩ	1 mA	14.0 V	100 + 100	2.5 + 1

Continuity Characteristics

Continuity High Limit User-selectable; default 10 Ω.

NOTES

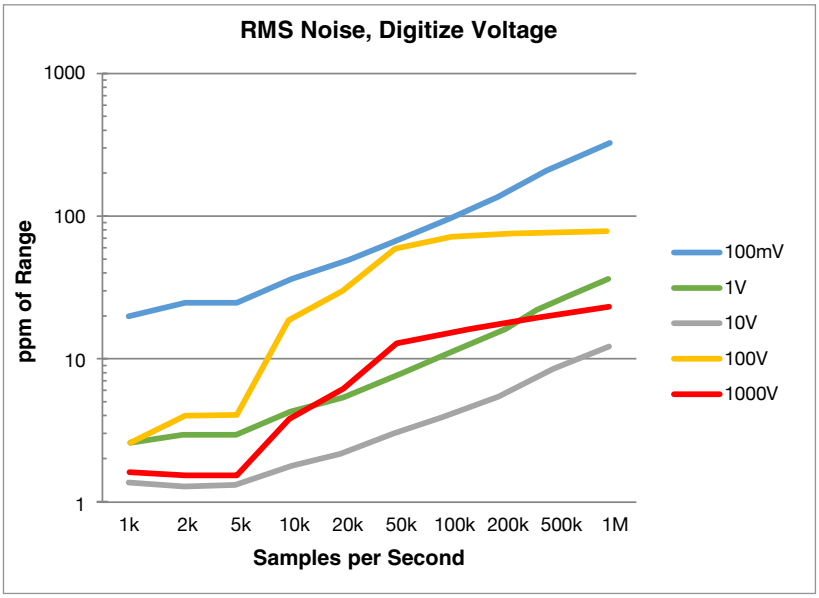
38. Exclusive of cold-junction errors.
39. Specifications exclude lead resistance.
40. Add per degree from T_{CAL} ±5 °C; specifications without autocalibration.

Digitize Voltage

Accuracy (Input Impedance AUTO)

Range [41, 42]	Resolution [43]	Input Impedance [44]	Accuracy ±(ppm of reading + ppm of range)			
			90 Day T_{CAL} ±5 °C	1 Year T_{CAL} ±5 °C	2 Year T_{CAL} ±5 °C	Temperature Coefficient [45]
100.000 mV	1 µV	>10 GΩ or 10 MΩ ±1%	210 + 100	220 + 100	230 + 100	15 + 20
1.00000 V	10 µV	>10 GΩ or 10 MΩ ±1%	110 + 75	120 + 75	130 + 75	15 + 20
10.0000 V	0.1 mV	>10 GΩ or 10 MΩ ±1%	110 + 75	120 + 75	130 + 75	10 + 20
100.000 V [46]	1 mV	10 MΩ ±1%	110 + 75	120 + 75	130 + 75	15 + 20
1000.00 V [47]	10 mV	10 MΩ ±1%	110 + 75	120 + 75	130 + 75	10 + 20

DC-Coupled Additional Noise Uncertainty, Typical [48]



NOTES

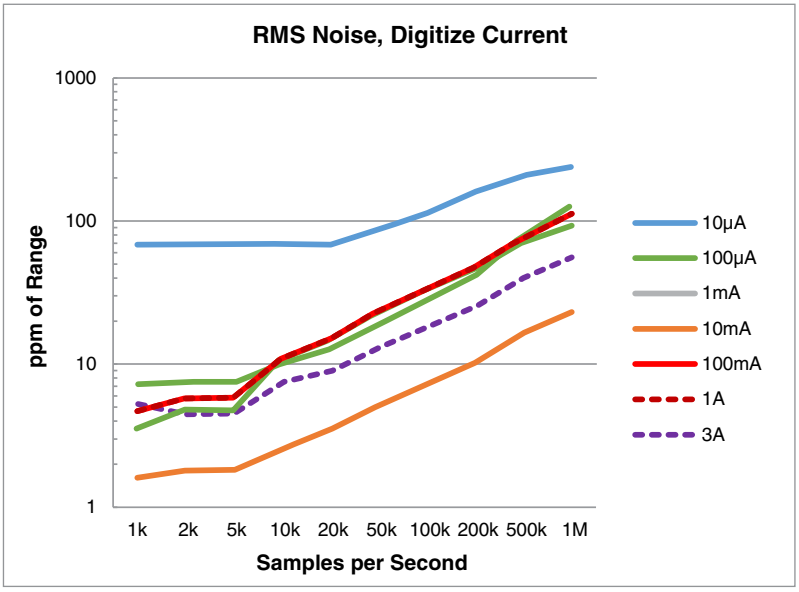
41. For DC coupling, 20% overrange for 100 mV to 100 V. For AC coupling, 500% overrange 100 mV to 100 V. 1% for 1000 V range DC coupling.
42. Accuracy with sample rate 1 k per second, aperture auto, and 100 reading buffer average.
43. Power up default is 4½ digits.
44. User-selectable.
45. Add per degree from T_{CAL} ± 5%.
46. For 100 V range, input impedance auto and without ACAL, add 100 ppm of range additional uncertainty and 15 ppm/°C additional uncertainty for "of range" temperature coefficient for operation outside of T_{CAL} ±5 °C.
47. For signal levels greater than 500 V, add 0.02 ppm/V to the ppm of the readings specification for measurements exceeding 500 V.
48. Specified with aperture Auto and 4-wire short on input terminals. For 100 V range, input impedance 10 MΩ, multiply by 2.5. For all ranges and sample rate > 1 k, add an additional 3× RMS noise uncertainty to ppm of range.

Digitize Current

DC Accuracy [49]

Range [50]	Resolution [51]	Burden Voltage	Accuracy ± (ppm of reading + ppm of range)			
			90 Day T_{CAL} ±5 °C	1 Year T_{CAL} ±5 °C	2 Year T_{CAL} ±5 °C	Temperature Coefficient [52]
10.0000 µA	0.1 nA	15 mV	150 + 75	160 + 75	170 + 75	30 + 15
100.000 µA	1 nA	15 mV	150 + 75	160 + 75	170 + 75	30 + 15
1.00000 mA	10 nA	15 mV	150 + 75	160 + 75	170 + 75	30 + 15
10.0000 mA	100 nA	20 mV	150 + 75	160 + 75	170 + 75	30 + 15
100.000 mA	1 µA	200 mV	340 + 100	450 + 100	560 + 100	50 + 20
1.00000 A	10 µA	400 mV	400 + 110	500 + 110	600 + 110	50 + 25
3.00000 A	100 µA	1300 mV	650 + 150	900 + 150	900 + 150	50 + 25

Additional Noise Uncertainty, Typical [53]



NOTES

49. Accuracy with sample rate 1 k per second, aperture auto, and 100 reading buffer average.
50. 20% overrange on all ranges except 3.3% for 3 A range.
51. Power up default is 4½ digits.
52. Add per degree from T_{CAL} ±5 °C.
53. Specified with aperture Auto and open input terminals. For all ranges and for ≥1 k sample rate, add an additional 3× RMS noise uncertainty to ppm of range.

Digitizer Characteristics

Maximum Resolution	18 bits.
Measurement Input Coupling	DC or AC (voltage only).
Sampling Rate [54]	Programmable 1 k through 1 million.
Volatile Sample Memory with Timestamp	27.5 million.
Minimum Record Time	1 µs.
Timestamp Resolution	1 ns with standard or full buffer style. 1 µs with compact buffer style.
Timestamp Accuracy	With standard or full buffer style, 20 ns between adjacent readings, with total buffer time <2 s. With compact buffer style, 2 µs adjacent readings, with total buffer buffer time <2 s.
Maximum Record Length	8 million.

Typical Reading Rates, 60 Hz (50 Hz) Operation [55, 56, 57, 58]

		Functions: DC Voltage (10 V), 2-wire Ohms (≤10 kΩ), DC Current (1 mA)		Functions: 4-wire ohms (≤1 kΩ), 4-wire/3-wire RTD		Functions: Thermistor		Functions: Dry Circuit (≤1 kΩ)	
NPLC	Digits	Measurements Into Buffer	Measurements Into Computer	Measurements Into Buffer	Measurements Into Computer	Measurements Into Buffer	Measurements Into Computer	Measurements Into Buffer	Measurements Into Computer
1	7½	59.8 (49.8)	58 (48)	29 (24)	28 (24)	57 (48)	57 (48)	27 (23)	26 (22)
0.2	6½	295 (240)	250 (210)	128 (109)	119 (100)	230 (200)	230 (200)	100 (89)	96 (85)
0.06	5½	965 (810)	950 (800)	310 (280)	315 (280)	900 (750)	900 (750)	190 (180)	190 (180)
0.006	4½	7500 (6700)	7300 (6500)	750 (730)	740 (720)	6800 (6000)	6800 (6000)	295 (290)	295 (290)
0.0005	3½	26000 (26000)	24000 (24000)	860 (860)	860 (860)	18000 (18000)	18000 (18000)	310 (310)	310 (310)

Digitize, Typical

Sampling Rate	Digits	Resolution	Measurements Into Computer [58]
10 kS/s	5½	18	9700
20 kS/s	4½	16	19000
50 kS/s	4½	16	44400
100 kS/s	4½	15	80000
1 MS/s	3½	12	108000

NOTES

54. Sample rate is not continuously adjustable. For valid discrete settings, see the DMM7512 Reference Manual.
55. Reading speeds for autozero off, fixed range, autodelay off. Offset compensation off and open lead detector off where applicable.
56. Buffer measurements: For <0.2 PLC, multisample, single buffer transfer binary reading only.
57. PC measurements: For 1 and 0.2 PLC single reading and single transfer to computer (USB).
58. Reading rates using factory default operating conditions and autorange off, autodelay off. Speeds include measurement and data transfer out of the USB. ≥1000 readings with binary transfer over USB.

System Performance, Typical

Mode 3½-digit, autozero off, 0.0005 PLC, excludes measurement time.

Time includes function change from DC voltage or 2-wire ohms to listed function.

Function	Function Change (ms)	Range Change (ms)
DC Voltage or 2-wire ohms (<10 kΩ)	6	1.3
4-wire ohms (<10 kΩ)	7	1.3
DC Current	7	1.3
Digitize Voltage or Current	7	1.3

Ranges for Function Change Times

Function change times apply to the ranges listed in the table below.

Function	Range
DC Voltage	10 V
2-wire or 4-wire Ohms	1 kΩ
DC Current	1 mA
Thermocouple	Use DC Voltage rates
Thermistor	Use 2-wire Ohms rates

Buffer Transfer Speed (Binary)	Measurements into Computer (per second)	
	USB	LAN
Average for 1000 readings	280000	270000
Average for 1000 readings with timestamp	170000	140000

Triggering

Time Base Accuracy	25 ppm.
Trigger Source	Analog DCV, DCI, or any system trigger.
Trigger Coupling	DC.
Input Trigger Latency [59, 60, 61]	<225 ns.
Input Trigger Jitter [59, 60]	<50 ns.
Sample period Jitter [59, 60]	<1 ns.

DMM Triggers

EXT TRIG IN and OUT	0 V to 5 V logic signal input and output, TTL compatible.
EXT trigger latency (IN and OUT)	<400 ns.
EXT trigger latency (IN or OUT)	<200 ns (guaranteed by design).

NOTES

59. Guaranteed by design; for digital I/O only.
60. Stimulus command required to meet specifications.
61. If using trigger model, add 200 ns uncertainty.

Analog Triggering [62]

Analog Level, Edge, or Window Trigger Types [63]

Trigger Characteristics	Voltage Input	Current Input
Input Range	100 mV to 1000 V	10 µA to 3 A
Resolution	0.05%	0.05%
Basic Accuracy (T_{ACAL} ±5 °C) [64, 65]	1%	1%

Analog Trigger Latencies

	Digital I/O	External
Positive Logic	800 ns + 40 ns jitter	930 ns + 40 ns jitter
Negative Logic	800 ns + 40 ns jitter	840 ns + 40 ns jitter

Window Filter and Memory (buffer)

Window Filter Size	0 to 10% of reading, where 0 averages all readings.
Memory	Up to 27.5 million timestamped readings with the compact buffer style, with additional memory available using an external USB flash drive.
Maximum Internal Memory (Buffer)	27.5 million readings with the compact buffer style (6½-digit without formatting), 11 million readings with the standard or full buffer style.

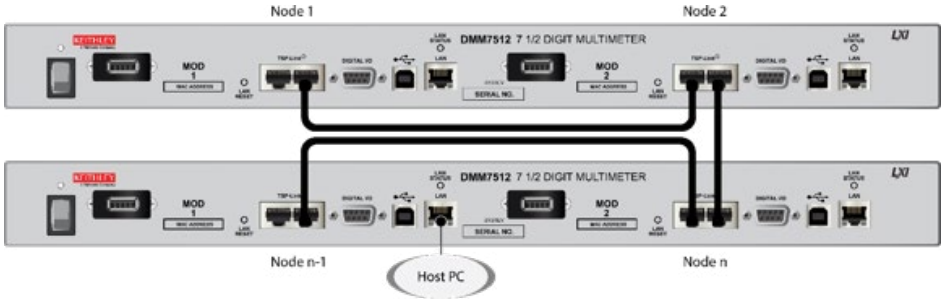
NOTES

62. For DC coupled, the trigger level can be set up to 100% of measure range.
63. Rising or falling edge triggering supported. Window trigger requires setting two independent levels.
64. Trigger event occurs after the threshold crossing at a time determined by total trigger latencies.
65. Accuracy specifications require user ACAL and are verified with level trigger amplitude set to 50% of range with a 100 Hz sine wave at 100% full scale of range. High frequency rejection is off. NPLC 0.0005 (DC voltage/DC current) or aperture 1 µs for digitize voltage or digitize current. Specified for fixed range, autozero off. For DC current and digitized DC current 3 A range, add an additional 2%.

General Instrument Specifications

Input Protection	1010 V DC all ranges and functions on HI and LO terminals; 350 V all ranges and functions on sense HI, sense LO terminals; 250 V rated current input terminal; fused 3 A range; current input terminals protected to 1 kV.
3 A Input Fuse Protection	3.5 A, 1 kV fast blow type; Keithley part number DMM7510-FUSE-3A.
Common Mode Isolation	500 VDC or ACV_{PEAK} LO to chassis. All terminals >10 GΩ, <350 pF any terminal to chassis.
Power Line	Universal input, 100 V to 240 V.
Line Frequency	50 Hz or 60 Hz, automatically sensed at power-up.
Power Consumption	165 VA.
Operating Environment	Specified for 0 °C to 50 °C, ≤70% relative humidity up to at 35 °C; derate 3% relative humidity per °C, 35 °C to 50 °C.
Storage Environment	–25 °C to 65 °C.
Altitude	Maximum 2000 m (6562 ft) above sea level.
Pollution Degree	2.
Real Time Clock	Lithium battery backup (3+ years battery life).
EMC	Conforms to European Union EMC Directive.
Safety	NRTL listed to UL61010-1 and CSA C22.2 No 61010-1; conforms with European Union Low Voltage Directive.
Vibration	MIL-PRF-28800F Class 3, Random.
Warm-up	4 hours to rated accuracy.
Input Signal Connections	Rear safety banana jacks.
Cooling	Forced air, side intake, and rear exhaust.
Dimensions	**Rack Mount:** 44 mm high × 483 mm wide × 696 mm deep (1.7 in. × 19 in. × 27.41 in.)
Shipping Weight	11.3 kg (25.0 lb.).
Digital I/O	
Connector	9-pin female D.
5V Power Supply Pin	Limited to 500 mA at >4 V (solidstate fuse protected).
Lines	Six input/output, user-defined, for digital I/O or triggering.
Input Signal Levels:	0.7 V (maximum logic low) 3.7 V (minimum logic high).
Input Voltage Limits:	–0.25 V (absolute minimum) +5.25 V (absolute maximum).
Maximum Source Current	+2.0 mA at >2.7 V (per pin).
Maximum Sink Current	–50 mA at 0.7 V (per pin, solid-state fuse protected).
Handler	User-defined start of test, end of test, four category bits
Math Functions	Rel, dB, Limit Test, Percentage, 1/x, and mX + b.
Remote Interface	
LAN	RJ-45 connector, 10/100BT; Virtual Front Panel.
USB Device (front panel, type B)	2.0 full speed, USBTMC compliant.
USB Host (front panel, type A)	USB 2.0, support for flash drives, FAT 32.
LXI Compliance	LXI version 1.4 Core 2011.

Language	Embedded Test Script Processor (TSP) accessible from any host interface; responds to high-speed test scripts comprised of remote commands and statements (for example, branching, looping, math); able to execute high-speed test scripts stored in memory without host intervention; also SCPI (default command set).
Expansion Interface	The TSP-Link expansion interface allows TSP-enabled instruments to trigger and communicate with each other. See the figure below.



The DMM7512 has four TSP-Link connectors (two on each module) to make it easier to connect instruments in a sequence.

- Once instruments are interconnected through the TSP-Link expansion interface, a computer can access all of the resources of each source measure instrument through the host interface of any TSP-Link instrument.
- A maximum of 32 TSP-Link nodes can be interconnected. Each source-measure module uses one TSP-Link node.

IP configuration	Static or DHCP (manual or automatic).

Ordering Information

DMM7512 Dual Channel 7 ½-Digit Sampling Multimeter

Supplied Accessories

012178100	Test Lead Kit, Quantity 4
CA-18-16A	LAN Crossover Cable, 40 cm (16 in), quantity 2
174710700	Shielded Crossover Cable with RJ-45 Connector, 1.5 m (5 ft), quantity 1
CA-568-120A	Green and Yellow Ground Cable, 3.0 m (120 in), quantity 1
4299-13	1U High Fixed Rack Mount Kit, quantity 1
0713411	Safety Precautions Document
071357600	DMM7512 7½-Digit Multimeter Instrument Information

Instruction Manuals/Documentation (available at www.tek.com/DMM7512)

	DMM7510 7.5 Digit Graphical Sampling Multimeter Reference Manual
	DMM7510 7.5 Digit Graphical Sampling Multimeter User's Manual

Software and Drivers (available at tek.com)

	IVI/VISA Drivers for Microsoft® Visual Basic®, Visual C/C++®
	Keithley Test Script Builder available at https://www.tek.com/keithley-test-script-builder

Power Cord Options

A0	North America (120 V, 60 Hz)
A1	Universal Euro (220 V, 50 Hz)
A2	United Kingdom {240 V, 50 Hz)
A3	Australia (240 V, 50 Hz)
A4	Chile, Italy (220 V, 50 Hz)
A5	Switzerland (220 V, 50 Hz)
A6	Japan (100 V, 50/60 Hz)
A7	Denmark (230 V, 50 Hz)
A8	Israel (230 V, 50 Hz)
A9	Argentina (220 V, 50 Hz)
A10	China (230 V, 50 Hz)
A11	India (230 V, 50 Hz)
A12	Brazil (127 V/220 V, 60 Hz)
A99	No power cord

Available Accessories

Test Leads and Probes

1751	Safety Test Leads
1754	2-Wire Universal 10-Piece Test Lead Kit
1756	General Purpose Test Lead Kit
5804	Kelvin (4-Wire) Universal 10-Piece Test Lead Kit
5805	Kelvin (4-Wire) Spring-Loaded Probes
5806	Kelvin Clip Lead Set
5808	Low Cost Single-pin Kelvin Probe Set
5809	Low Cost Kelvin Clip Lead Set
8606	High Performance Modular Probe Kit
8610	Low Thermal Shorting Plug

Replacement Fuses

FU-106-3.15	Line Power Fuse, 250 V, 3.15 A, Slow Blow 5 × 20 mm
DMM7510-FUSE-3A	3.5 A Current Fuse

Cables, Connectors, Adapters

CA-18-1	Shielded Dual Banana Cable, 1.2 m (4 ft.)

Cables

CA-180-3A	CAT5 Crossover Cable for TSP-Link / Ethernet
USB-B-1	USB Cable, Type A to Type B, 1 m (3.3 ft)

Triggering and Control

2450-TLINK	DB-9 to Trigger Link Connector Adapter
8501-1	Trigger Link Cable, DIN-to-DIN, 1 m (3.2 ft.)
8501-2	Trigger Link Cable, DIN-to-DIN, 2 m (6.5 ft.)
8503	DIN-to-BNC Trigger Cable

Rack Mount Kit

4299-13	1U High Fixed Rack Mount Kit

Available Services

Extended Warranties

DMM7512-EW	1 Year Factory Warranty Extended to 2 Years from Date of Shipment
DMM7512-3Y-EW	1 Year Factory Warranty Extended to 3 Years from Date of Shipment
DMM7512-5Y-EW	1 Year Factory Warranty Extended to 5 Years from Date of Shipment

Calibration Contracts

C/DMM7512-3Y-STD	KeithleyCare 3 Year Std Calibration Plan
C/DMM7512-3Y-DATA	KeithleyCare 3 Year Calibration w/Data Plan
C/DMM7512-3Y-17025	KeithleyCare 3 Year ISO-17025 Calibration Plan
C/DMM7512-5Y-STD	KeithleyCare 5 Year Std Calibration Plan
C/DMM7512-5Y-DATA	KeithleyCare 5 Year Calibration w/Data Plan
C/DMM7512-5Y-17025	KeithleyCare 5 Year ISO-17025 Calibration Plan

Warranty Information

Warranty Summary	This section summarizes the warranties of the DMM7512. For complete warranty information, refer to the DMM7512 Reference Manual. Any portion of the product that is not manufactured by Keithley is not covered by this warranty and Keithley will have no duty to enforce any other manufacturer's warranties.
Hardware Warranty	Keithley Instruments, Inc. warrants the Keithley manufactured portion of the hardware for a period of one year from defects in materials or workmanship; provided that such defect has not been caused by use of the Keithley hardware which is not in accordance with the hardware instructions. The warranty does not apply upon any modification of Keithley hardware made by the customer or operation of the hardware outside the environmental specifications.
Software Warranty	Keithley warrants for the Keithley produced portion of the software or firmware will conform in all material respects with the published specifications for a period of ninety (90) days; provided the software is used on the product for which it is intended in accordance with the software instructions. Keithley does not warrant that operation of the software will be uninterrupted or error-free, or that the software will be adequate for the customer's intended application. The warranty does not apply upon any modification of the software made by the customer.

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