Digital Multimeters

Tektronix DMM4020 Datasheet



DMM4020

Features & Benefits

Key Performance Specifications

- 5.5 Digit Resolution
- Basic VDC Accuracy of up to 0.015% (1 yr.)
- 200 mV to 1000 V Voltage Range, with up to 1 µV Resolution
- 200 µA to 10 A Current Range, with up to 1 nA Resolution
- 200 Ω to 100 MΩ Range, with up to 1 mΩ Resolution
- CAT I 1000 V, CAT II 600 V

Available Functions and Features

- Volts, Ohms, and Amps Measurements
- True RMS (AC, AC + DC) Measurements
- Diode and Continuity Testing
- Frequency Measurements
- 2×4 Ohms 4-wire Measurement Technique
- Dedicated DC Leakage Current Measurements
- Six Dedicated Buttons for Fast Access to Instrument Setups
- Limit Compare Mode for Pass/Fail Testing

Connectivity

- Front 2×4 Measurement Inputs
- RS-232 on Rear Panel for Quick PC Connectivity
- Includes USB to RS-232 Interface Adapter Cable
- Includes National Instrument's LabVIEW SignalExpress™ TE Limited Edition for Connecting Your Bench

3-year Warranty

Tektronix®

Measurements with the Push of a Button

As the circuits in embedded system designs become more sophisticated, you must measure a multitude of different parameters to validate your design. The Tektronix DMM4020 5.5 digit bench multimeter offers a broad range of functions in one easy-to-use instrument.

Typical multimeter measurements – volts, ohms, and amps – are made with a basic VDC accuracy of up to 0.015%, ensuring you have the performance you need for your design. You can also use the DMM4020 to measure frequency, and to perform continuity and diode tests. This allows you to replace your counter, continuity tester, and DMM with one versatile instrument, saving bench space and cost.

Measure Nanoampere Signals

Measuring standby current in today's energy-efficient designs requires looking at very low currents, often in the microamp or nanoamp range. Using a traditional multimeter for this measurement can lead to inaccurate results since they typically employ the shunt resistance technique for measuring current.

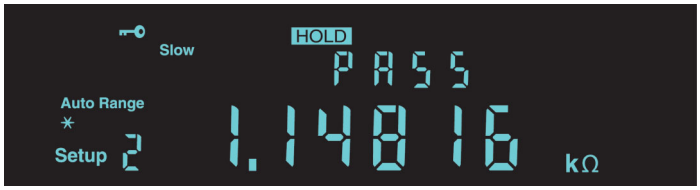
The DMM4020 offers an improved method for measuring low currents. By using a current-to-voltage op amp technique, the DMM4020 can make current measurements with 1 nA of resolution and with minimal loading affect on the circuit under test, giving results that reflect real-world operation of the device.

Designed to Make Your Work Easier

The DMM4020 multimeter is designed with the ease of use and familiar operation you expect from Tektronix.

Intuitive Operation

Dedicated front-panel buttons provide fast access to frequently used functions and parameters, reducing setup time. You no longer need to search through software menus to find the function you need.



Limit compare mode on the DMM4020.

Setup Buttons for Your Common Measurements

With six setup buttons on the front panel, you can save the settings for your most common measurements. Simply set up the meter for a measurement, then press shift followed by a setup button to save the measurement settings. Now each time you perform that measurement, you simply press the appropriate setup key.

Dual Display

With the unique dual display, you can measure two different parameters of the same signal from one test connection.

Limit Compare

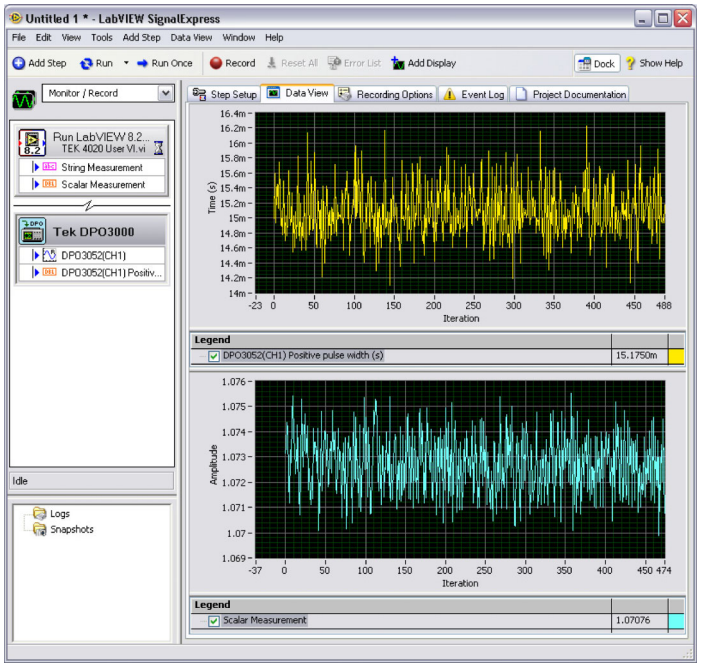
The limit compare mode provides pass/fail indicators to quickly show if a test passes or fails to help eliminate mistakes, especially for results that are close to the limit.

Simple and Accurate 4-wire Measurements

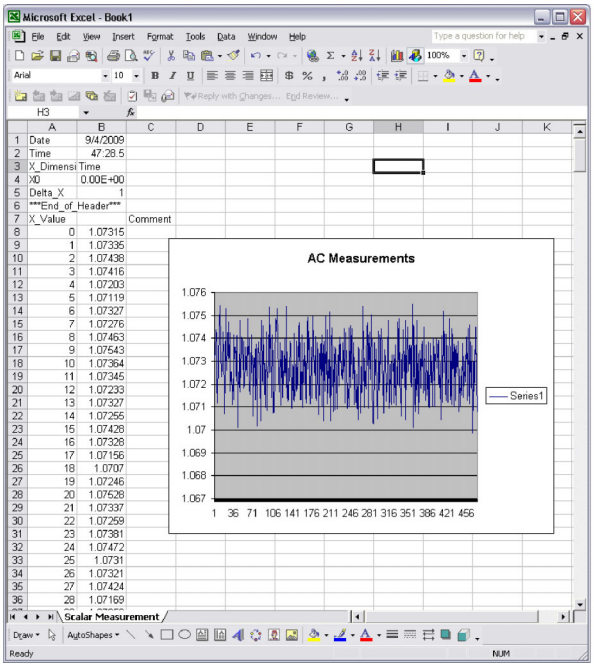
Patented split terminal jacks for the 2×4 ohms function allow you to perform 4-wire measurements using only two leads instead of four. Special test lead accessories are available to enable you to establish the connection. You get excellent resolution and accuracy plus the convenience and ease of using a single pair of leads.

Easy Connectivity to Your PC

The RS-232 port on the back panel can be used to connect to your PC. A USB to RS-232 interface adapter cable is included standard with the DMM4020 for connecting to your PC's USB port.



SignalExpress acquiring data from Tektronix DMM4020 and DPO3052.



SignalExpress used to export DMM4020 data into Excel.

Connect Your Bench for Intelligent Debug

Easily capture, save, and analyze measurement results from your multimeter with the special Tektronix Edition of National Instrument's LabVIEW SignalExpress™ software. Every DMM4020 multimeter ships with a free copy of the Limited Edition version of SignalExpress for basic instrument control, data logging, and analysis. The optional Professional Edition offers over 200 built-in functions that provide additional signal processing, advanced analysis, sweeping, limit testing, and user-defined step capabilities.

SignalExpress supports the range of Tektronix bench instruments*[1], enabling you to connect your entire test bench. You can then access the feature-rich tools packed into each instrument from one intuitive software interface. This allows you to automate complex measurements requiring multiple instruments, log data for an extended period of time, time correlate data from multiple instruments, and easily capture and analyze your results, all from your PC. Only Tektronix offers a connected test bench of intelligent instruments to simplify and speed debug of your complex design.

Performance You Can Count On

In addition to industry-leading service and support, every DMM4020 multimeter comes backed with a three-year standard warranty.

*[1] NI LabVIEW SignalExpress supports the following Tektronix instruments: MSO/DPO4000/3000/2000 Series oscilloscopes, TDS3000C/2000B/1000B Series oscilloscopes, AFG3000 Series arbitrary/function generators, DMM4050/4040/4020 Series digital multimeters.

Characteristics

General Specifications

Voltage

Characteristic	Description
100V Setting	90 V to 110 V
120V Setting	108 V to 132 V
220V Setting	198 V to 242 V
240V Setting	216 V to 264 V
Frequency	47 Hz to 440 Hz
Power Consumption	15 VA peak (10 W average)

Dimensions

Dimension	mm	in.
Height	88	3.46
Width	217	8.56
Depth	297	11.7
Weight	**kg**	**lb.**
Net	2.1	4.6

Display

Vacuum Fluorescent Display, segment

Environment

Characteristic	Description
Temperature	
Operating	0 °C to 50 °C
Storage	–40 °C to 70 °C
Warm Up	½ hour to full uncertainty specifications
Relative Humidity (noncondensing)	
Operating	Uncontrolled (<10 °C) <90% (10 °C to 28 °C) <75% (28 °C to 40 °C) <45% (40 °C to 50 °C)
Storage	<95% (–40 °C to 70 °C)
Altitude	
Operating	2,000 meters
Storage	12,000 meters
Vibration	Complies with MIL-PRF-28800F Class 3
Safety	Complies with IEC 61010-1:2001, ANSI/ISA 61010-1 (S82.02.01):2004, UL 61010-1:2004, CAN/CSA C22.2 No. 61010.1:2004, CAT I 1000V / CAT II 600 V
EMC	Designed to comply with IEC 61326-1:1997+A1:1998+A2:2000

Triggering

Characteristic	Description
Trigger Delay	400 ms
External Trigger Delay	<2 ms
External Trigger Jitter	<1 ms
Trigger Input	TTL Levels
Trigger Output	5 V max

Math Functions

Min/Max, relative, hold, compare, and dB functions

Multiple Measurement Combinations

Secondary Function	Primary Function					
	DC V	AC V	DC I	AC I	FREQ	OHMS
DC V	X	X	X	X		
AC V	X	X	X	X	X	
DC I	X	X	X	X		
AC I	X	X	X	X		
FREQ		X			X	
OHMS						X

Electrical

Characteristic	Description
Input Protection	1000 V all ranges
Overrange	10% on the largest ranges of all functions except continuity and diode test

Remote Interfaces

RS-232C (RS-232 to USB Adapter cable included)

Warranty

Three years

Electrical Specifications

DC Voltage Specifications

Specifications are valid for 5½ digit mode and after at least a half-hour warm up.

Characteristic	Description
Maximum Input	1000 V on any range
Common Mode Rejection	120 dB at 50 or 60 Hz 0.1% (1 kΩ unbalance)
Normal Mode Rejection	80 dB at Slow Rate
A/D Nonlinearity	15 ppm of range
Input Bias Current	<30 pA at 25 °C
Settling Considerations	Measurement settling times are affected by source impedance, cable dielectric characteristics, and input signal changes

Input Characteristics

Range	Full Scale (5½ Digits)	Resolution			Input Impedance
		Slow	Medium	Fast	
200 mV	199.999 mV	1 µV	10 µV	10 µV	>10 GΩ*2
2 V	1.99999 V	10 µV	100 µV	100 µV	>10 GΩ*2
20 V	19.9999 V	100 µV	1000 µV	1000 µV	10 MΩ ±1%
200 V	199.999 V	1 mV	10 mV	10 mV	10 MΩ ±1%
1000 V	1000.00 V	10 mV	100 mV	100 mV	10 MΩ ±1%

*2 At some dual-display measurements, the input impedance of 200 mV and 2 V ranges may be changed to 10 MΩ.

Accuracy

Range	Uncertainty*3		Temperature Coefficient/°C Outside 18 - 28 °C
	90 days	1 year	
	23 °C ±5 °C	23 °C ±5 °C	
200 mV	0.01 + 0.003	0.015 + 0.004	0.0015 + 0.0005
2 V	0.01 + 0.002	0.015 + 0.003	0.001 + 0.0005
20 V	0.01 + 0.003	0.015 + 0.004	0.0020 + 0.0005
200 V	0.01 + 0.002	0.015 + 0.003	0.0015 + 0.0005
1000 V	0.01 + 0.002	0.015 + 0.003	0.0015 + 0.0005

*3 Uncertainty given as ±(% of reading + % of range).

AC Voltage Specifications

AC Voltage specifications are for AC sinewave signals >5% of range. For inputs from 1% to 5% of range and <50 kHz, add an additional error of 0.1% of range, and for 50 kHz to 100 kHz, add 0.13% of range.

Characteristic	Description
Maximum Input	750 V_{RMS} or 1000 V peak or 8 × 10^7 Volts-Hertz product
Measurement Method	AC-coupled true RMS. Measures the AC component of input with up to 1000 VDC bias on any range
AC Filter Bandwidth	20 Hz - 100 kHz
Common Mode Rejection	60 dB at 50 Hz or 60 Hz (1 kΩ unbalance)
Maximum Crest Factor	3:1 at Full Scale
Additional Crest Factor Errors (<100 Hz)	Crest Factor 1-2, 0.05% of full scale Crest Factor 2-3, 0.2% of full scale **Only applies for non-sinusoid signals**

Input Characteristics

Range	Full Scale (5½ Digits)	Resolution			Input Impedance
		Slow	Medium	Fast	
200 mV	199.999 mV	1 µV	10 µV	10 µV	1 MΩ ±2% shunted by <100 pf
2 V	1.99999 V	10 µV	100 µV	100 µV	
20 V	19.9999 V	100 µV	1000 µV	1000 µV	
200 V	199.999 V	1 mV	10 mV	10 mV	
750 V	750.00 V	10 mV	100 mV	100 mV	

Accuracy

Range	Frequency	Uncertainty*3		Temperature Coefficient/°C Outside 18 - 28 °C
		90 days	1 year	
		23 °C ±5 °C	23 °C ±5 °C	
200 mV	20 Hz - 45 Hz	0.8 + 0.05	0.9 + 0.05	0.01 + 0.005
	45 Hz - 20 kHz	0.15 + 0.05	0.2 + 0.05	0.01 + 0.005
	20 kHz - 50 kHz	0.3 + 0.05	0.35 + 0.05	0.01 + 0.005
	50 kHz - 100 kHz	0.8 + 0.05	0.9 + 0.05	0.05 + 0.01
2 V	20 Hz - 45 Hz	0.8 + 0.05	0.9 + 0.05	0.01 + 0.005
	45 Hz - 20 kHz	0.15 + 0.05	0.2 + 0.05	0.01 + 0.005
	20 kHz - 50 kHz	0.3 + 0.05	0.35 + 0.05	0.01 + 0.005
	50 kHz - 100 kHz	0.8 + 0.05	0.9 + 0.05	0.05 + 0.01
20 V	20 Hz - 45 Hz	0.8 + 0.05	0.9 + 0.05	0.01 + 0.005
	45 Hz - 20 kHz	0.15 + 0.05	0.2 + 0.05	0.01 + 0.005
	20 kHz - 50 kHz	0.3 + 0.05	0.35 + 0.05	0.01 + 0.005
	50 kHz - 100 kHz	0.8 + 0.05	0.9 + 0.05	0.05 + 0.01
200 V	20 Hz - 45 Hz	0.8 + 0.05	0.9 + 0.05	0.01 + 0.005
	45 Hz - 20 kHz	0.15 + 0.05	0.2 + 0.05	0.01 + 0.005
	20 kHz - 50 kHz	0.3 + 0.05	0.35 + 0.05	0.01 + 0.005
	50 kHz - 100 kHz	0.8 + 0.05	0.9 + 0.05	0.05 + 0.01
750 V	20 Hz - 45 Hz	0.8 + 0.05	0.9 + 0.05	0.01 + 0.005
	45 Hz - 20 kHz	0.15 + 0.05	0.2 + 0.05	0.01 + 0.005
	20 kHz - 50 kHz	0.3 + 0.05	0.35 + 0.05	0.01 + 0.005
	50 kHz - 100 kHz	0.8 + 0.05	0.9 + 0.05	0.05 + 0.01

*3 Uncertainty given as ±(% of reading + % of range).

Resistance

Specifications are for 4-wire resistance function, or 2-wire resistance with REL. If REL is not used, add 0.2 Ω for 2-wire resistance plus lead resistance.

Characteristic	Description
Measurement Method	Current source referenced to LO input
Max Lead Resistance (4-wire ohms)	10% of range per lead for 200 Ω, 2 kΩ ranges. 1 kΩ per lead on all other ranges
Input Protection	1000 V on all ranges

Input Characteristics

Range	Full Scale (5½ Digits)	Resolution			Current Source
		Slow	Medium	Fast	
200 Ω	199.999 Ω	0.001 Ω	0.01 Ω	0.01 Ω	0.8 mA
2 kΩ	1.99999 kΩ	0.01 Ω	0.1 Ω	0.1 Ω	0.8 mA
20 kΩ	19.9999 kΩ	0.1 Ω	1 Ω	1 Ω	0.08 mA
200 kΩ	199.999 kΩ	1 Ω	10 Ω	10 Ω	0.008 mA
2 MΩ	1.99999 MΩ	10 Ω	100 Ω	100 Ω	0.9 µA
20 MΩ	19.9999 MΩ	100 Ω	1 kΩ	1 kΩ	0.16 µA
100 MΩ	100.000 MΩ	1 kΩ	10 kΩ	10 kΩ	0.16 µA || 10 MΩ

Accuracy

Range	Uncertainty*[3]		Temperature Coefficient/°C Outside 18 - 28 °C
	90 days	1 year	
	23 °C ±5 °C	23 °C ±5 °C	
200 Ω	0.02 + 0.004	0.03 + 0.004	0.003 + 0.0006
2 kΩ	0.015 + 0.002	0.02 + 0.003	0.003 + 0.0005
20 kΩ	0.015 + 0.002	0.02 + 0.003	0.003 + 0.0005
200 kΩ	0.015 + 0.002	0.02 + 0.003	0.003 + 0.0005
2 MΩ	0.03 + 0.003	0.04 + 0.004	0.004 + 0.0005
20 MΩ	0.2 + 0.003	0.25 + 0.003	0.01 + 0.0005
100 MΩ	1.5 + 0.004	1.75 + 0.004	0.2 + 0.0005

*[3] Uncertainty given as ±(% of reading + % of range).

DC Current

Characteristic	Description
Input Protection	Tool-accessible 11 A / 1000 V and 440 mA / 1000 V fuses
Shunt Resistance	0.01 Ω for 2 A and 10 A ranges 1 Ω for 20 mA and 200 mA Burden voltage <5 mV for 200 µA and 2 mA range

Input Characteristics

Range	Full Scale (5½ Digits)	Resolution			Burden Voltage
		Slow	Medium	Fast	
200 µA	199.999 µA	0.001 µA	0.01 µA	0.01 µA	<5 mV
2 mA	1999.99 µA	0.01 µA	0.1 µA	0.1 µA	<5 mV
20 mA	19.9999 mA	0.1 µA	1 µA	1 µA	<0.05 V
200 mA	19.9999 mA	1 µA	10 µA	10 µA	<0.5 V
2 A	1.99999 A	10 µA	100 µA	100 µA	<0.1 V
10 A	10.0000 A	100 µA	1 mA	1 mA	<0.5 V

Accuracy

Range	Uncertainty*[3]		Temperature Coefficient/°C Outside 18 - 28 °C
	90 days	1 year	
	23 °C ±5 °C	23 °C ±5 °C	
200 µA	0.02 + 0.005	0.03 + 0.005	0.003 + 0.001
2 mA	0.015 + 0.005	0.02 + 0.005	0.002 + 0.001
20 mA	0.03 + 0.02	0.04 + 0.02	0.005 + 0.001
200 mA	0.02 + 0.005	0.03 + 0.008	0.005 + 0.001
2 A	0.05 + 0.02	0.08 + 0.02	0.008 + 0.001
10 A	0.18 + 0.01	0.2 + 0.01	0.008 + 0.001

*[3] Uncertainty given as ±(% of reading + % of range).

AC Current

The following AC current specifications are for sinusoidal signals with amplitudes greater than 5% of range. For inputs from 1% to 5% of range, add an additional error of 0.1% of range.

Characteristic	Description
Input Protection	Tool-accessible 11 A / 1000 V and 440 mA / 1000 V fuses
Measurement Method	AC-coupled true RMS
Shunt Resistance	0.01 Ω for 2 A and 10 A ranges 1 Ω for 20 mA and 200 mA
AC Filter Bandwidth	20 Hz - 100 kHz
Maximum Crest Factor	3:1 at Full Scale
Additional Crest Factor Errors (<100 Hz)	Crest Factor 1-2, 0.05% of full scale Crest Factor 2-3, 0.2% of full scale **Only applies to non-sinusoid signals**

Input Characteristics

Range	Full Scale (5½ Digits)	Resolution			Burden Voltage
		Slow	Medium	Fast	
20 mA	19.9999 mA	0.1 µA	1 µA	1 µA	<0.05 V
200 mA	199.999 mA	1 µA	10 µA	10 µA	<0.5 V
2 A	1.99999 A	10 µA	100 µA	100 µA	<0.1 V
10 A	10.0000 A	100 µA	1 mA	1 mA	<0.5 V

Accuracy

Range	Frequency	Uncertainty*3		Temperature Coefficient/°C Outside 18 - 28 °C
		90 days	1 year	
		23 °C ±5 °C	23 °C ±5 °C	
20 mA	20 Hz - 45 Hz	1 + 0.05	1.25 + 0.06	0.015 + 0.005
	45 Hz - 2 kHz	0.25 + 0.05	0.3 + 0.06	0.015 + 0.005
200 mA	20 Hz - 45 Hz	0.8 + 0.05	1 + 0.06	0.015 + 0.005
	45 Hz - 2 kHz	0.25 + 0.05	0.3 + 0.06	0.015 + 0.005
2 A	20 Hz - 45 Hz	1 + 0.05	1.25 + 0.06	0.015 + 0.005
	45 Hz - 2 kHz	0.25 + 0.05	0.3 + 0.06	0.015 + 0.005
10 A	20 Hz - 45 Hz	1 + 0.1	1.25 + 0.12	0.015 + 0.005
	45 Hz - 2 kHz	1 + 0.1	0.5 + 0.12	0.015 + 0.005

*3 Uncertainty given as ±(% of reading + % of range).

Frequency

Characteristic	Description
Gate Time	131 ms
Measurement Method	AC-coupled input using the AC voltage measurement function
Settling Considerations	When measuring frequency after a DC offset voltage change, errors may occur. For the most accurate measurement, wait up to 1 second to allow input-blocking RC time constant to settle
Measurement Considerations	To minimize measurement errors, shield inputs from external noise when measuring low-voltage, low-frequency signals

Input Characteristics

Range	Frequency	Uncertainty		Temperature Coefficient/°C Outside 18 - 28 °C
		90 days	1 year	
		23 °C ±5 °C	23 °C ±5 °C	
100 mV to 750 V*[4, 5]	20 Hz - 2 kHz	0.01 + 0.002	0.01 + 0.003	0.002 + 0.001
	2 kHz - 20 kHz	0.01 + 0.002	0.01 + 0.003	0.002 + 0.001
	20 kHz - 200 kHz	0.01 + 0.002	0.01 + 0.003	0.002 + 0.001
	200 kHz - 1 MHz	0.01 + 0.004	0.01 + 0.006	0.002 + 0.002

*[4] Input >100 mV.

*[5] Limited to 8×10^7 V Hz.

Continuity

Characteristic	Description
Continuity Threshold	20 Ω
Test Current	1 mA
Response Time	100 S/s with audible tone
Rate	Fast
Maximum Reading	199.99 Ω
Resolution	0.01 Ω

Diode Test

Characteristic	Description
Response Time	100 S/s with audible tone
Rate	Fast
Maximum Reading	1.9999 V
Resolution	0.1 mV

Ordering Information

Models

Model	Description
DMM4020	5.5 Digit Multimeter

DMM4020 Includes: Meter, TL710 Test Leads, Line Cord, Statement of Cal Practices (Order option D1 for traceable calibration certificate and data report), Safety and Installation Instructions including Warranty Statement, CD-ROM with User Manual (English, French, Italian, German, Spanish, Simplified Chinese, Traditional Chinese, Korean, Russian, Japanese) and Connectivity Information, RS-232 to USB Adapter Cable, National Instruments LabVIEW SignalExpress™ Tektronix Edition, Limited Edition Software.

Please specify power plug when ordering.

Instrument Options

Power Plug Options

Option	Description
Opt. A0	North America
Opt. A1	Universal Euro
Opt. A2	United Kingdom
Opt. A3	Australia
Opt. A5	Switzerland
Opt. A6	Japan
Opt. A10	China
Opt. A11	India
Opt. A12	Brazil
Opt. E1	Euro and UK power cords

Service Options*6

Option	Description
Opt. CA1	Provides a single calibration event or coverage for the designated calibration interval, whichever comes first
Opt. D1	Provides traceable calibration certificate and data report
Opt. R5	Repair Service 5 Years (including warranty)

*6 Test Leads and accessories are not covered by the DMM warranty and Service Offerings. Refer to the datasheet of each Test Lead and accessory model for its unique warranty and calibration terms.

Recommended Accessories and Software

Accessory	Description
Calibration Manual	077-0365-xx
196-3520-xx	Premium Test Leads (replacement/spare for TL710)
TL705	2×4 Wire Ohm 1000 V Precision Test Lead
TL725	2×4 Wire Ohm SMD Test Tweezers
ACD4000	Soft Transit Case
HCTEK4321	Hard Carrying Case
RMU2U	Rackmount Shelf Kit for 1 or 2 Units
013-0369-xx	Calibration Fixture 4-terminal short
196-3520-00	TL710 Premium Test Lead
SIGEXPTE	NI LabVIEW SignalExpress Tektronix Edition Software – Full Version

CE

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

GPIB IEEE-488

Product(s) complies with IEEE Standard 488.1-1987 and RS-232C.

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900

Austria 00800 2255 4835*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777

Belgium 00800 2255 4835*

Brazil +55 (11) 3759 7627

Canada 1 800 833 9200

Central East Europe and the Baltics +41 52 675 3777

Central Europe & Greece +41 52 675 3777

Denmark +45 80 88 1401

Finland +41 52 675 3777

France 00800 2255 4835*

Germany 00800 2255 4835*

Hong Kong 400 820 5835

India 000 800 650 1835

Italy 00800 2255 4835*

Japan 81 (3) 6714 3010

Luxembourg +41 52 675 3777

Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90

Middle East, Asia, and North Africa +41 52 675 3777

The Netherlands 00800 2255 4835*

Norway 800 16098

People's Republic of China 400 820 5835

Poland +41 52 675 3777

Portugal 80 08 12370

Republic of Korea 001 800 8255 2835

Russia & CIS +7 (495) 6647564

South Africa +41 52 675 3777

Spain 00800 2255 4835*

Sweden 00800 2255 4835*

Switzerland 00800 2255 4835*

Taiwan 886 (2) 2722 9622

United Kingdom & Ireland 00800 2255 4835*

USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

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