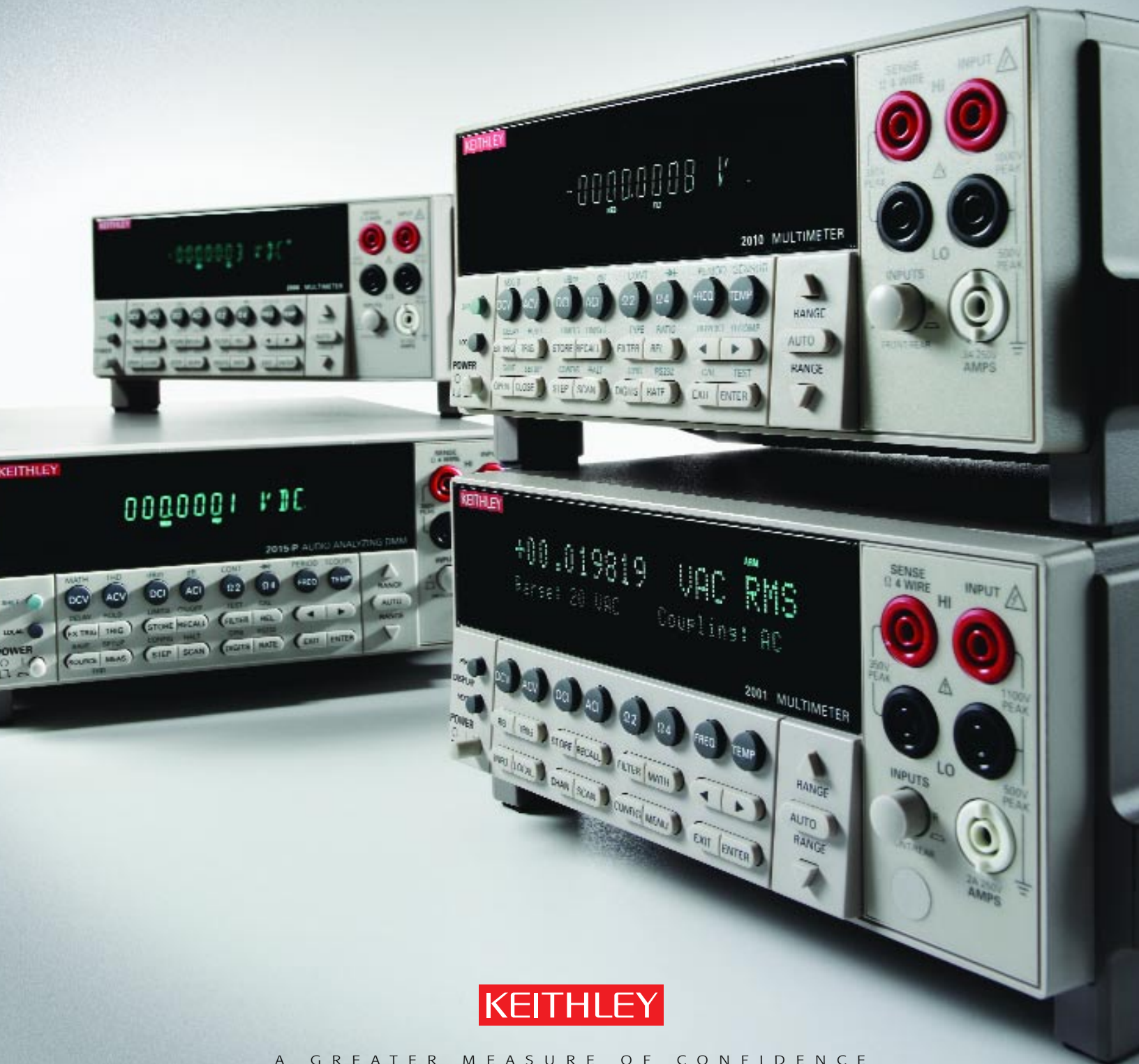


# Precision, multi-purpose solutions for evolving test needs

## Series 2000 High Performance Digital Multimeters



**KEITHLEY**

A GREATER MEASURE OF CONFIDENCE

- A complete set of measurement tools in one compact enclosure
- Superior measurement integrity
- Easy to find a cost-effective solution for a specific application
- Easy migration from model to model as applications evolve
- Exceptional long-term reliability



# Meet our high performance family

Each Series 2000 Digital Multimeter offers a unique combination of measurement capabilities that make them ideal for high speed production testing. Their half-rack design fits easily into just about any test rack or benchtop. With maximum resolutions from 6½ to 8½ digits and a variety of built-in capabilities, there's sure to be a Series 2000 DMM that matches your application.

## *Go to work with the right tools*

Series 2000 multimeters are essentials for anyone's basic electrical toolbox because they combine all the measurement capabilities needed for electronic device and sub-system measurements, operational circuit measurements, and electronic product development and validation for bench and in ATE applications.

## *Be confident of your measurement integrity*

All Series 2000 DMMs are based on the same high speed, low noise 28-bit A/D converter technology for superior measurement precision, sensitivity, and traceability. The Models 2001 and 2002 incorporate five distinct processors for tighter A/D control, higher accuracy, more precise triggering, higher throughput, and support for a variety of advanced capabilities.

## *Get high value plus high performance*

A wide range of price and performance options are available, so it's easy to find a cost-effective match for your application. Whether you need the speed and economy of the basic Model 2000, the ultra-high precision of the Model 2002, or something in between, there's a Series 2000 DMM that's right for the job. All Series 2000 models are capable of reading rates of up to 2000 readings/sec (at 4½ digits).

## *Migrate your applications easily from instrument to instrument*

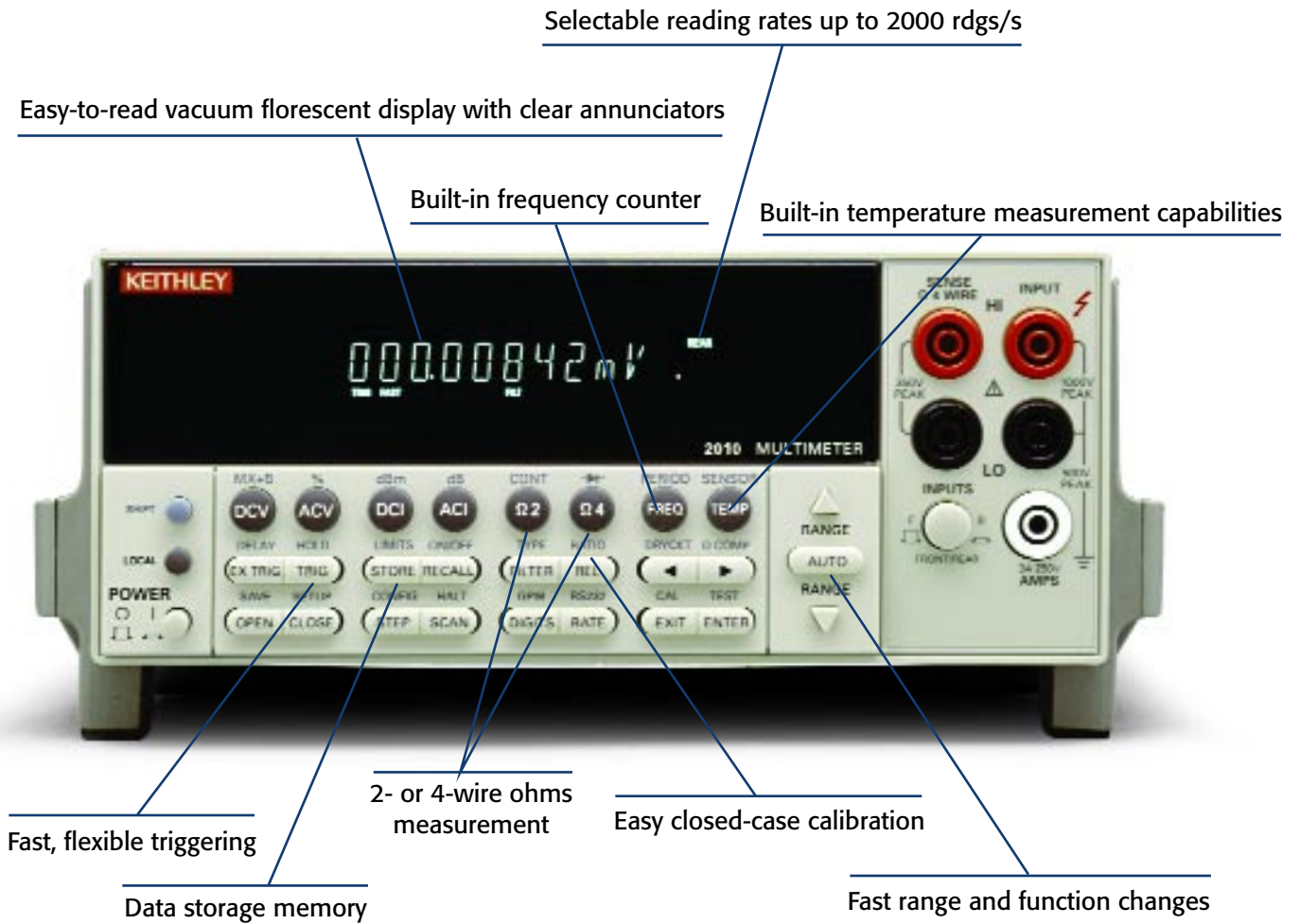
The common SCPI programming and software architecture simplifies migrating applications to more capable instruments as new test needs arise or when substituting a Keithley DMM for a meter from another manufacturer.

## *Handle tomorrow's test challenges with today's test solution*

Series 2000 DMMs have earned a reputation for exceptional long-term performance and reliability. Each one is backed with a standard three-year warranty. Built-in measurement, signal conditioning, switching, and data communications functions give you the flexibility to repurpose your instrument readily as your test needs change over time.

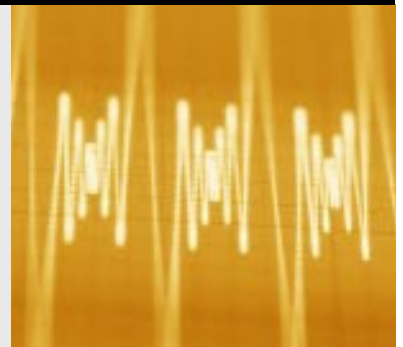
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# A broad range of built-in functions



## Application: Low level resistance testing

The Model 2010 is made for low resistance applications like testing the reliability of electrical connectors. With a measurement range of  $1\mu\Omega$  to  $120M\Omega$ , it ensures more precise low level readings. Device self-heating is minimized when testing low ohms components, because resistance measurements can be made with source current as low as  $100\mu A$ . The Model 2010's dry circuit test mode clamps the open circuit voltage at 20mV to prevent punctures in any oxides or films that may have formed on contacts and connectors, so the measurement derived reflects the "in use" resistance. An offset compensated ohms function eliminates error-causing thermal effects from cabling and connections.



IEEE-488 bus simplifies controlling a wide range of GPIB instruments

Trigger Link for fast, precise, repeatable triggering of multiple instruments



Built-in scanner mainframe accepts optional switching cards for multi-point testing

Visit [www.keithley.com](http://www.keithley.com) to download a wide range of application notes, articles, data sheets, and specifications on Series 2000 DMMs.

## Application: Power supply monitoring



The Model 2001's multiple display capability makes it easy to gather several pieces of information simultaneously from different aspects of a single signal. One of these displays is ideal for power supply monitoring because it shows the DC voltage of the supply's output, the AC noise level, and the frequency of that noise all at once, which simplifies tracking down the source of the noise and correcting it.

# Individualized solutions for specific application needs

## *Model 2000: Get high accuracy without a high price tag*

The 6½-digit Model 2000 has unique capabilities that simplify building and upgrading automated production test systems. For example, the built-in limit testing function can be used to sort or grade components or assemblies. It also offers a full resolution reading rate (50 rdg/s) that's nearly ten times faster than any other meter in its class and a maximum speed of 2000 rdgs/s. Built-in math functions let you make a variety of calculations on the acquired data without a computer controller.



## *Model 2010: Resolve low level signals quickly and accurately*

With a noise floor of just 100nV RMS, the 7½-digit Model 2010 is designed for high accuracy millivolt- and microvolt-level measurements. It also wraps up all the functions needed for characterizing the resistance, linearity, or isolation of contacts, connectors, switches, or relays in a single instrument. With built-in capabilities like a low power ohms mode, dry circuit testing, offset-compensated ohms, and a 10Ω range, the Model 2010 DMM is ideal for developing, validating, or production testing sensors, transducers, A/D and D/A converters, regulators, references, connectors, switches and relays. It's equally appropriate for end-of-life contact testing per ASTM B539-90.



## *Model 2001: Advanced features you never thought a DMM could offer*

The Model 2001 couples exceptional accuracy (0.0018% basic), resolution, and sensitivity with measurement and mathematical capabilities rarely found in DMMs. Its internal peak detector can catch 1μs spikes, such as power supply spikes and transients, AC line power surges, and short-duration dropouts on components, as well as up to 1MHz for repetitive signals. With the Model 2001, it's easy to measure AC peak value, average, and true rms directly to characterize the signal thoroughly.



## Application: Precision resistor testing



The Model 2002's unique one-phase four-wire ohms measurement capability makes it a good solution for high speed production testing of precision resistors. Two high and two low limits can be tied to the status of any of four protected digital outputs, so the Model 2002 can sort or grade the resistors automatically after testing. For QA tests on small samples, the front panel bar graph display makes it easy to determine the tolerances of individual resistors.

## *Model 2002: Truly usable 8½-digit resolution*

The Model 2002 offers the same advanced features and functions as the Model 2001, then adds an extra decade of resolution and broader DC voltage, temperature, and resistance ranges. The Model 2002's performance is specified for a  $\pm 5^{\circ}\text{C}$  environment, not a  $\pm 1^{\circ}\text{C}$  environment, and no daily re-calibration is required to stay in spec, so it's ideal for high accuracy production test applications. An "open lead" detection function helps identify problems that could lead the system to pass components that should have failed a test. Built-in digital I/O capabilities and a pass/fail testing function simplify connecting it to a variety of handlers for fast, efficient device binning and sorting.



## *Models 2015 and 2016: Audio analysis plus full-featured DMMs*

Each of these specialized instruments combines audio band quality measurements and analysis with a full-function 6½-digit DMM for production testing of audio devices and sub-systems. The Models 2016 and 2016-P provide twice the sine wave generator output of the Models 2015 and 2015-P for applications that require test signals greater than 8Vrms. The Models 2015-P and 2016-P offer additional processing capacity for frequency spectrum analysis. All four models can measure Total Harmonic Distortion (THD) over the complete 20Hz to 20kHz audio band, as well as compute THD+Noise and Signal-to-Noise plus Distortion (SINAD). These capabilities are critical for applications such as assessing non-linear distortion in components, devices, and systems. Five industry-standard bandpass filters are provided for shaping the input signal for audio and telecommunication applications. Refer to the Selector Guide on pages 10-11 for specification information.



*Refer to the Selector Guide on pages 10-11 to compare the capabilities of different models.*

## **Application: THD analysis and frequency response** The Model 2015, 2015-P, 2016,

The Model 2015, 2016-P, 2016, and 2016-P can provide both time domain and frequency domain measurements in a single test protocol. Keithley can help you configure a system for testing telecommunication devices, such as mobile phones. These instruments can perform a frequency domain analysis of the Total Harmonic Distortion (THD) and the first three harmonics as a function of frequency, as well as a time domain analysis of microphone circuit output voltage as a function of frequency.



# Building blocks for a comprehensive system solution

## *Plug-in scanner cards*

To create test and measurement systems with up to ten measurement points quickly and economically, choose from three plug-in scanner cards designed specifically for several Series 2000 DMMs. Just slide one of these cards into the option slot on the meter's back panel and you'll combine scanning and measurement capabilities in a single instrument.

**The Model 2000-SCAN 10-Channel Scanner Card** is designed for use with Model 2000, 2010, 2001, and 2002 DMMs. It supports multiplexing one of ten two-pole or one of five four-pole signals into the DMM and/or any combination of two- or four-pole signals.

**The Model 2001-SCAN Scanner Card** is a high speed multiplexing scanner card developed for the Model 2000, 2010, 2001, and 2002 DMMs. This card transforms your meter into a high accuracy, high speed ten-channel datalogger for a variety of mixed-signal applications. Two high speed solid-state channels on the card allow calculating ratio and delta when it's installed in the Model 2001, 2002, or 2010.

When used with a Model 2000, 2001, 2002, or 2010 DMM, the **Model 2001-TCSCAN Thermocouple Scanner Card** provides up to nine channels of cold-junction compensated temperature measurements and/or voltage, resistance, and frequency measurements. When the card is installed in the Model 2001 or 2002, the DMM will linearize type J, K, E, R, S, B, and T thermocouples automatically. When used with the Model 2001, 2002, or 2010, it allows measuring temperature directly using two- or four-wire RTDs.



## **Extended range and sensitivity**

The Model 1801 Nanovolt Pre-Amp extends the range and sensitivity of Model 2001 and 2002 DMMs by amplifying extremely low-level signals. It combines a variety of measurement functions, including DCV, ACV rms, four-wire ohms, frequency, and temperature. A nine-foot cable links the pre-amp unit to a power supply card, which installs in the DMM's back panel option slot. This remote architecture isolates the Model 1801's sensitive "chopper-type" amplification circuitry, so the unit can be located close to the test setup to keep test leads short, reducing interference.





# Need greater switching capacity?

Choosing the right switching solution is often crucial to ensuring high measurement integrity and productivity in production testing. Keithley's Applications Engineers can help you determine the most appropriate configuration for your application.

If your application requires more than ten channels of switching capacity, consider Keithley's **Series 2700 Integra multimeter/data acquisition/switching systems**. The 80-channel Model 2700 and Model 2701 mainframes offer the industry's lowest per-channel installed cost in high performance data acquisition and control packages. A built-in Ethernet interface in the Model 2701 makes it the best choice for distributed applications. With five module slots, the Model 2750 simplifies configuring solutions for applications with hundreds of channels. A choice of 12 plug-in modules makes Integra systems almost infinitely adaptable.

**Series 7000 switching solutions** complement Series 2000 DMMs when building multi-point test systems. The 80-channel Model 7001 High Density Switch System will accept a wide variety of switching cards for signals up to 2GHz. Similarly, the Model 7002 Switch Mainframe will support up to 400 channels or crosspoints, with a unique interactive channel status display. Both mainframes are compatible with Keithley's line of more than 40 Series 7000 Switching Cards.

The two-slot **Model 7002-HD Switch Mainframe** combines the channel density of the Model 7002 with the half-rack footprint of the Model 7001. Two new high density switch cards mainframe let you create a system with up to 384 matrix crosspoints or 320 multiplexer channels.



## Choose the Series 2000 DMM that matches your application

Models		2000	2010
	<b>Digits</b>	<b>6½</b>	<b>7½</b>
	Expansion Channels	10	10
DC Volts	Sensitivity	100 nV	10 nV
	Maximum Reading	1000 V	1000 V
	Basic Accuracy	0.002%	0.0018%
	Ratio		•
	DC Peak Spikes		
AC Volts (TRMS)	Sensitivity	100 nV	100 nV
	Maximum Reading	750 V	750 V
	Basic Accuracy	0.05%	0.05%
	Bandwidth	3 Hz-300 kHz	3 Hz-300 kHz
	dB, dBm	•	•
	Frequency, Period	•	•
	Peak/Avg/RMS		
	AC, AC+DC		
	THD, Harmonics		
	4V Sine Source		
Ohms (2/4 Wire)	9V Sine Source		
	Sensitivity	100 µΩ	1 µΩ
	Maximum Reading	120 MΩ	120 MΩ
	Basic Accuracy	0.008	0.0032%
	Continuity Test	•	•
	Diode Test	•	•
	Offset Compensation		•
	Dry Circuit		•
	Constant Current	•	•
	Open Source Detection		
DC Amps	Sensitivity	10 nA	10 nA
	Range Span	10 mA- 3A	10 mA-3 A
	Basic Accuracy	0.03%%	0.03%
	In Circuit Current		
AC Amps (TRMS)	Sensitivity	1 µA	1 µA
	Range Span	1 A-3 A	1 A- 3A
	Basic Accuracy	0.1%	0.1%
	Bandwidth	3 Hz-5 kHz	3 Hz-5 kHz
General Features	Interface	GPIO, RS-232	GPIO, RS-232
	Reading Hold	•	•
	Digital I/O		
	Reading Memory	1024 rdgs	1024 rdgs
	Maximum Speed	2000 rdgs	2000 rdgs
	Temperature Meas.	T/C	TC, RTD
	Language Emulation	8840/42, 196/199	196, 199
	Memory Options	–	–
		2000-SCAN	2000-SCAN
Compatible Scanner Cards	2001-SCAN	2001-TCSCAN	
	2001-TCSCAN		

Visit [www.keithley.com](http://www.keithley.com) or call your local office for more information on our other switching solutions (p. 9).

<b>2001</b>	<b>2002</b>	<b>2015, 2015-P</b>	<b>2016, 2016-P</b>
<b>7½</b>	<b>8½</b>	<b>6½</b>	<b>6½</b>
10	10		
10 nV	10 nV	100 nV	100 nV
1100 V	1100 V	1000 V	1000 V
0.0018%	0.0006%	0.002%	0.002%
Option	Option		
100 nV	100 nV	100 nV	100 nV
775 V (1100 V pk)	775 V (1100 V pk)	750 V	750 V
0.03%	0.02%	0.05%	0.05%
1 Hz-2 MHz	1 Hz-2 MHz	3 Hz-300 kHz	3 Hz-300 kHz
•	•	•	•
•	•	•	•
•	•		
•	•		
		•	•
		• (2015-P)	• (2016-P)
		•	•
1 µΩ	100 nΩ	100 µΩ	100 µΩ
1 GΩ	1 GΩ	120MΩ	120MΩ
0.0032%	0.0007%	0.008%	0.008%
		•	•
•	•	•	•
•	•	•	•
		•	•
10 pA	10 pA	10 nA	10 nA
200 µA-2 A	200 µA-2 A	10 mA-3 A	10 mA-3 A
0.03%	0.027%	0.03%	0.03%
•	•		
100 pA	100 pA	1 µA	1 µA
200 µA-2 A	200 µA-2 A	1 A-3 A	1 A-3 A
0.1%	0.1%	0.1%	0.1%
20 Hz-100 kHz	20 Hz-100 kHz	3 Hz-5 kHz	3 Hz-5 kHz
GPIB	GPIB	GPIB, RS-232	GPIB, RS-232
		•	•
•	•	2 in/5 out (TTL)	2 in/5 out (TTL)
Opt. to 30,000	Opt. to 30,000	1024 rdgs	1024 rdgs
2000 rdgs	2000 rdgs	2000 rdgs	2000 rdgs
T/C, RTD	T/C, RTD	T/C	T/C
	HP 3458		
MEM1: 32K	MEM1: 32K	–	–
MEM2: 128K	MEM2: 128		
2000-SCAN	2000-SCAN	–	–
2001-SCAN	2001-SCAN		
2001-TCSCAN	2001-TCSCAN		

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## Need somebody to talk to?

There's a Keithley applications engineer ready with advice on configuring your test and measurement system. Call us toll free at 1-888-KEITHLEY (534-8453) (US only) or call your local Keithley sales office and ask to speak with one of our low level instrumentation specialists.



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# KEITHLEY

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