SM2064/2060
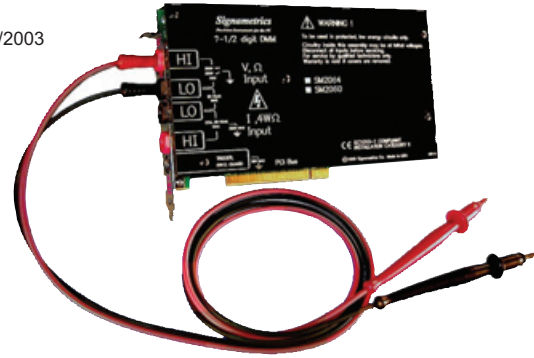## 7-$\frac{1}{2}$ Digit PCI Digital Multimeter

Features

- Flexible, full-featured auto-ranging DMM
- 7-$\frac{1}{2}$ digit resolution
- 20,000 readings/second (SM2064)
- 1,400 readings/second (SM2060)
- DC & AC voltage & current, 2-wire, 4-wire, 6-wire (SM2064) ohms
- Frequency and time measurements
- Capacitance & inductance measurements (SM2064)
- Voltage & current sourcing (SM2064)
- Precise trigger capabilities
- 330V isolation barrier
- Self-calibrating
- Plug-and-Play software with graphical user interface
- Fully programmable with Visual Basic, C++, LabView etc.

- **Operating Systems**
  - Windows 98/NT/2000/XP/2003

- **Recommended Software**
  - VB/VC++/BCB/Delphi
  - DAQBench

Introduction

The SM2064 and SM2060 are much faster than any bench-top DMM, and maintain high accuracy at high measurement rates. The measurement speed is up to 20,000 readings/second for SM2064. The SM206x series provides a comprehensive set of DMM capabilities, including 2-wire, 4-wire, and 6-wire guarded resistance measurements; inductance and capacitance; leakage and temperature; frequency and timing; sourcing of voltage and current; and much more. The SM2064 and SM2060 Digital Multimeters are easy to setup and use, have sophisticated analog and digital circuitry to provide repeatable measurements, and are protected to handle any unexpected situation your measurement environment may encounter. With high performance and variable applications, the SM2064 and SM2060 are suitable for automated production testing, laboratory automation, and portable/field testing.

Specifications

Specifications subject to change without notice.
For the most current and complete specifications, please refer to the user manual.

DC Functions
DC Voltage

Accuracy ± (% of reading + Volts) [1]

Range	Full scale 7-$\frac{1}{2}$ Digits	Resolution	Input Resistance	24 hours 23˚C±1˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
240mV	240.00000mV	10nV	>10 GΩ	0.003 + 1µV	0.004 + 1.5µV	0.005 + 2µV
2.4V	2.4000000V	100nV	>10 GΩ	0.002 + 3µV	0.0025 + 5µV	0.003 + 5µV
24V	24.000000V	1µV	10 MΩ	0.004 + 120µV	0.005 + 130µV	0.006 + 150µV
240V	240.00000V	10µV	10 MΩ	0.003 + 250µV	0.004 + 300µV	0.005 + 0.5mV
330V	330.00000V	10µV	10 MΩ	0.005 + 550µV	0.01 + 700µV	0.015 + 0.8mV

[1] With Aperture set to ≥ 0.5 sec, and within one hour from Self Calibration (S-Cal)

DC Current

Accuracy ±(% of reading + Amps) [1]

Range	Full scale 6-$\frac{1}{2}$ Digits	Resolution	Max Burden Voltage	24 hours 23˚C±5˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
240nA[2]	240.0000nA	0.1pA	100µV	0.07 + 40pA	0.1 + 45pA	0.17 + 60pA
2.4µA[2]	2.400000nA	1pA	100µV	0.05 + 70pA	0.08 + 90pA	0.21 + 150pA
24µA[2]	24.00000µA	10pA	100µV	0.05 + 400pA	0.08 + 600pA	0.13 + 0.8nA
240µA[2]	240.000µA	10nA	2.5mV	0.052 + 200nA	0.07 + 300nA	0.1 + 400nA
2.4mA	2.40000mA	10nA	25mV	0.05 + 300nA	0.06 + 400nA	0.07 + 550nA
24mA	24.0000mA	100nA	250mV	0.05 + 350nA	0.065 + 450nA	0.08 + 550nA
240m	240.000mA	1µA	55mV	0.05 + 50µA	0.055 + 60µA	0.065 + 80µA
2.4A	2.40000A	10µA	520mV	0.3 + 60µA	0.4 + 70µA	0.45 + 90µA

[1] With Aperture set to ≥0.96 sec, and within one hour from zero (Relative control).
[2] Available only with the SM2064.

2-Wire Resistance

Accuracy ± (% of reading + Ω) [1]

Range [3]	Full scale 7-$\frac{1}{2}$ Digits	Resolution	Source Current	24 hours 23˚C±1˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
24Ω[2]	24.000000Ω	1µΩ	10mA	0.0038 + 1.4mΩ	0.005 + 1.6mΩ	0.008 + 2mΩ
240Ω	240.00000Ω	10µΩ	1mA	0.0037 + 4.5mΩ	0.0046 + 5mΩ	0.007 + 6mΩ
2.4kΩ	2.4000000kΩ	100µΩ	1mA	0.0023 + 28mΩ	0.004 + 32mΩ	0.006 + 33mΩ
24kΩ	24.000000kΩ	1mΩ	100µA	0.0025 + 300mΩ	0.004 + 330mΩ	0.006 + 350mΩ
240kΩ	240.00000kΩ	10mΩ	10µA	0.0055 + 3.2Ω	0.006 + 4Ω	0.007 + 5Ω
2.4MΩ	2.4000000MΩ	100mΩ	1µA	0.018 + 40Ω	0.03 + 50Ω	0.04 + 70Ω
24MΩ	24.0000MΩ	100Ω	100nA	0.12 + 400Ω	0.13 + 500Ω	0.2 + 600Ω
240MΩ[2]	240.000MΩ	1kΩ	10nA	0.8 + 20kΩ	1.0 + 30kΩ	1.3 + 50kΩ

[1] With Aperture set to ≥0.5 Sec, and within one hour from Self Calibration (S-Cal).
[2] Ranges are only with the SM2064.
[3] Test voltages are 2.4V max with the exception of the 24Ω and 240Ω ranges 240mV.

4-Wire Resistance

Accuracy ± (% of reading + Ω) [1]

Range [3]	Full scale 7-$\frac{1}{2}$ Digits	Resolution	Source Current	24 hours 23˚C±1˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
24Ω[2]	24.000000Ω	1µΩ	10mA	0.0038 + 0.7mΩ	0.005 + 0.8mΩ	0.008 + 1mΩ
240Ω	240.00000Ω	10µΩ	1mA	0.0037 + 3mΩ	0.0046 + 4mΩ	0.007 + 5mΩ
2.4kΩ	2.4000000kΩ	100µΩ	1mA	0.0023 + 28mΩ	0.004 + 32mΩ	0.006 + 33mΩ
24kΩ	24.000000kΩ	1mΩ	100µA	0.0025 + 300mΩ	0.004 + 330mΩ	0.006 + 350mΩ
240kΩ	240.00000kΩ	10mΩ	10µA	0.0055 + 3.2Ω	0.007 + 4 Ω	0.007 + 5Ω
2.4MΩ	2.4000000MΩ	100mΩ	1µA	0.018 + 40Ω	0.03 + 50Ω	0.04 + 70Ω
24MΩ	24.0000MΩ	100Ω	100nA	0.12 + 400Ω	0.13 + 500Ω	0.2 + 600Ω

[1] With Aperture set to ≥0.5 Sec, and within one hour from Self Calibration (S-Cal).
[2] Ranges are only with the SM2064.
[3] Test voltages are 2.4V max with the exception of the 24Ω and 240Ω ranges 240mV.

Diode Characterization

Maximum Diode Voltage Compliance	Available DC current Uncertainty	Typical Current Value	Typical Voltage Value Uncertainty
4V	100nA, 1µA, 10µA, 100µA and 1mA (SM2046 10mA&12.5mA)	1%	0.02%

AC Functions
AC Voltage (true RMS)

One Year Accuracy ± (% of reading + Volts), 23˚C±5˚C

Range	Full scale 7 -$\frac{1}{2}$ Digits	Resolution	10Hz - 20Hz	20Hz - 47Hz	47Hz - 10kHz	10kHz - 50kHz	50kHz-100kHz
240mV	240.00000mV	100nV	3.2 + 430µV	0.4 + 200µV	0.15 + 120µV	0.27 + 230µV	2.0 + 400µV
2.4V	2.4000000V	1µV	3.2 + 2.5mV	0.4 + 1.7mV	0.065 + 1.2mV	0.35 + 1.5mV	2.1 + 2mV
24V	24.000000V	10µV	3.3 + 20mV	0.4 + 16mV	0.073 + 13mV	0.22 + 25mV	1.5 + 40mV
240V	240.00000V	100µV	3.3 + 200mV	0.4 + 150mV	0.06 + 130mV	0.30 + 200mV	1.6 + 300mV
330V	330.00000V	100µV	3.3 + 200mV	0.45 + 250mV	0.09 + 230mV	0.32 + 300mV	1.6 + 400mV

AC Current (true RMS)

One Year Accuracy ± (% of reading + Amps), 23˚C±10˚C

Range	Full scale 6-1/2 Digits	Resolution	Max Burden Voltage (RMS)	10Hz - 20Hz[1]	20Hz - 47Hz[1]	47Hz - 1kHz[1]	1kHz - 10kHz[1]
2.4mA	2.400000mA	1nA	25mV	2.9 + 4µA	1.0 + 4µA	0.12 + 4µA	0.22 + 4µA
24mA	24.00000mA	10nA	250mV	2.8 + 30µA	1.0 + 30µA	0.16 + 30µA	0.4 + 40µA
240mA	240.0000mA	100nA	55mV	2.8 + 400µA	1.0 + 400µA	0.2 + 220µA	0.4 + 400µA
2.4A	2.400000A	1µA	520mV	2.7 + 5mA	0.9 + 6mA	0.35 + 4mA	0.5 + 5mA

[1] All AC Current ranges have typical measurement capability to 20 kHz.

Time Functions

Frequency and Period

ACV Mode

Input RMS Voltage range	Input Impedance	Frequency Range	Period Range	Resolution	Uncertainty
24mV - 250V	1MΩ with < 300pF	2Hz - 300kHz	0.5s - 3.33µs	5 1/2 digits	± 0.002% of reading

ACI Mode

Input Signal range	Input Impedance	Frequency Range	Period Range	Resolution	Uncertainty
0.33mA - 2.5A	10Ω(3mA & 30mA) 0.1Ω (330mA & 2.5A)	2Hz - 500kHz	0.5s - 2.0µs	5 1/2 digits	± 0.01% of reading

Pulse Width

Polarity	Frequency Range	Resolution	Width Range	Typical Uncertainty
Positive or negative pulse widths	2Hz to 100kHz	1µs	2µs to 1s	0.01% of reading ±4µs

Threshold DAC

Selected VAC Range	Threshold range (DC level)	Threshold DAC resolution	Highest allowed input Vp-p	Typical one year setting uncertainty
240mV	-1.0V to +1.0V	0.5mV	1.900 V	0.2% + 4mV
2.4V	-10.0V to +10.0V	5.0mV	19.00V	0.2% + 40mV
24V	-100.0V to +100.0V	50mV	190.0V	0.2% + 0.4V
240V	-400V to 400V	500mV	850.0V	0.2% + 4V

Totalizer

Active edge polarity	Maximum Count	Allowed rate	Condition
Positive or negative transition	10^9	1 to 30,000 events per second	Uses Threshold DAC

Capacitance and Inductance Specifications (SM2064 only)

Capacitance

Accuracy ±(% of reading + farads) [1]

Range	Full scale Reading	Resolution	One Year 23˚C±5˚C	Measurement Time	Measurement Rate (rps)
1,200pF	1,199.9pF	0.1pF	1.5 ± 0.25pF	52.3ms	19.1
12nF	11.999nF	1pF	1.2 ± 5pF	118ms	8.5
120nF	119.99nF	10pF	1.0	127ms	7.9
1.2µF	1.1999µF	100pF	1.0	175ms	5.7
12µF	11.999µF	1nF	1.0	480ms	2.1
120µF	119.99µF	10nF	1.0	50.3ms	19.9
1.2mF	1.1999mF	100nF	1.2	151.5ms	6.6
12mF	50.000mF	1µF	2	170ms	5.9

[1] Within one hour of zero, using relative control. Accuracy is specified for values higher than 5% of the selected range with the exception of the 1,200pF range.

Inductance

Accuracy ± (% of reading + henrys)

Range	Test Frequency	Full Scale 4 1/2 Digits	Resolution	One Year Accuracy 23˚C±5˚C [1]
24µH	75kHz	33.000µH	1nH	3.0% + 500nH
240µH	50kHz	330.00µH	10nH	2.0% + 3µH
2.4mH	4kHz	3.3000mH	100nH	1.5% + 25µH
24mH	1.5kHz	33.000mH	1µH	1.5% + 200µH
240mH	1kHz	330.00mH	10µH	2.5 + 3mH
2.4H	100Hz	3.3000H	100µH	3.0 + 35mH

[1] Accuracy is specified for values greater than 5% of the selected range.

Other measurement functions of SM2064: 6-wire guarded resistance, extended resistance, AC peak-to-peak voltage, AC crest factor, AC median value, leakage current, RTD temperature, thermocouple temperature

Source Functions (SM2064 only)

- DC Voltage Source
  - Output range: -10.000V to +10.000V
  - DAC resolution: 18 bits (closed loop), 12 bits (open loop)
- AC Voltage Source
  - Output range: 900mV to 8V
  - DAC resolution: 12 bits
  - Frequency range/resolution: 1 Hz to 200kHz/2mHz
- DC Current Source
  - Output range: 1.25µA to 12.5mA

Trigger Functions

- External Hardware Trigger (at DIN-7 connector)
  - Trigger input voltage level range: +3V to +15V
  - Minimum trigger input current: 1mA
- Analog Threshold Trigger
  - Trigger point: selectable positive or negative transition of set threshold
  - Captures up to 120 post-trigger readings for apertures > 625µ Sec.
  - Captures up to 80 post-trigger readings for apertures > 625µ Sec.
- Delayed Hardware Trigger
  - Up to 65mSec with 1µSec resolution
  - Up to 1s with 2µs resolution

General Specifications

- Overload Protection (voltage inputs): 330V$_{DC}$, 250V$_{AC}$
- Isolation: 330V$_{DC}$, 250V$_{AC}$ from earth ground
- Maximum Input (Volt x Hertz):
  - 8x10^6 volts x Hz normal mode input
  - 1x10^6 volts x Hz common mode input
- Calibration: Calibrations are performed by Signametrics in a computer at 23˚C internal temperature rise. All calibration constants are stored in a text file.
- Operating Temperature: -10 to 65˚C
- Storage Temperature: -40 to 85˚C
- Power requirements: +5 volts, 300mA maximum
- Dimensions (not including connectors): 208mm x 112mm
- Safety: Designed to IEC 1010-1, Installation Category II

Ordering Information

- **SM2064**
  7-1/2 digits PCI Digital Multimeter with LCR Meter
- **SM2060**
  7-1/2 digits PCI Digital Multimeter

1 Software Solutions
2 PXI/ CompactPCI Platforms
3 PXI-Based Instruments
4 PXI/ CompactPCI Modules
5 PCI DAQ Cards
6 PCI DIO Cards
7 PC/104-Plus Products
8 ISA DAS/ DIO Cards
9 Wiring Termination Boards
10 Motion Vision & COM
11 Remote I/O Modules
12 Industrial Computers