SMX2064/2060, SM2064/2060 Series

7-1/2 Digit Digital Multimeters

SMX2064

SM2060

Introduction

The SMX2064/2060 and SM2064/2060 series are 7-1/2 digit high-speed digital multimeters in PXI and PCI form factors, which maintain high accuracy at high measurement rates. The measurement speed is up to 20,000 readings/second for the SMX2064 and SM2064. The SMX206x and 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 SMX2064/2060 and SM2064/2060 series 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 SMX2064/2060 and SM2064/2060 series are suitable for automated production testing, laboratory automation, and portable/field testing.

Features

- **Flexible, full-featured auto-ranging DMM**
- **7-1/2 digit resolution**
- **20,000 readings/second (SMX2064, SM2064)**
- **1,400 readings/second (SMX2060, SM2060)**
- **DC & AC voltage & current, 2-wire, 4-wire, 6-wire (SMX2064, SM2064) ohms**
- **Frequency and time measurements**
- **Capacitance & inductance measurements (SMX2064, SM2064)**
- **Voltage & current sourcing (SMX2064, SM2064)**
- **Precise trigger capabilities**
- **330 V 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

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]

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

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

DC current

Accuracy ±(% of reading + Amps) [1]

240 mV	Full scale 7-1/2 Digits	Resolution	Max Burden Voltage	24 hours 23°C±1°C	90 Days 23°C±5°C	One Year 23°C±5°C
240 nA[2]	240.0000 nA	0.1 pA	100 μV	0.07 + 40 pA	0.1 + 45 pA	0.17 + 60 pA
2.4 μA[2]	2.400000 nA	1 pA	100 μV	0.05 + 70 pA	0.08 + 90 pA	0.21 + 150 pA
24 μA[2]	24.00000 μA	10 pA	100 μV	0.05 + 400 pA	0.08 + 600 pA	0.13 + 0.8 nA
240 μA[2]	240.000 μA	10 nA	2.5 mV	0.052 + 200 nA	0.07 + 300 nA	0.1 + 400 nA
2.4 mA	2.40000 mA	10 nA	25 mV	0.05 + 300 nA	0.06 + 400 nA	0.07 + 550 nA
24 mA	24.0000 mA	1 μA	250 mV	0.05 + 350 nA	0.065 + 450 nA	0.08 + 550 nA
240 m	240.000 mA	100 nA	55 mV	0.05 + 50 μA	0.055 + 60 μA	0.065 + 80 μA
2.4 A	2.40000 A	10 μA	520 mV	0.3 + 60 μA	0.4 + 70 μA	0.45 + 90 μA

[1] With Aperture set to ≥0.96 sec, and within one hour from zero (Relative control).

[2] Available only with the SMX2064 and SM2064.

2-Wire Resistance

Accuracy ± (% of reading + Ω) [1]

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

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

[2] Ranges are only with the SMX2064, SM2064.

[3] Test voltages are 2.4 V max with the exception of the 24 Ω and 240 Ω ranges at 240 mV.

4-Wire Resistance

Accuracy ± (% of reading + Ω) [1]

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

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

[2] Ranges are only with the SMX2064, SM2064.

[3] Test voltages are 2.4 V max with the exception of the 24 Ω and 240 Ω ranges at 240 mV.

Diode Characterization

Maximum Diode Voltage Compliance	Available DC current Uncertainty	Typical Current Value	Typical Voltage Value Uncertainty
4 V	100 nA, 1 µA, 10 µA, 100 µA and 0.02% 1 mA (SMX2064 and SM2064 10 mA & 12.5 mA)	1%	0.02%

AC Functions

AC Voltage (true RMS)

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

Range [3]	Full scale 7-1/2 Digits	Resolution	10 Hz - 20 Hz	20 Hz - 47 Hz	47 Hz - 10 kHz	10 kHz - 50 kHz	50 kHz-100 kHz
240 mV	240.00000 mV	100 nV	3.2 + 430 µV	0.4 + 200 µV	0.15 + 120 µV	0.27 + 230 µV	2.0 + 400 µV
2.4 V	2.4000000 V	1 µV	3.2 + 2.5 mV	0.4 + 1.7 mV	0.065 + 1.2 mV	0.35 + 1.5 mV	2.1 + 2 mV
24 V	24.000000 V	10 µV	3.3 + 20 mV	0.4 + 16 mV	0.073 + 13 mV	0.22 + 25 mV	1.5 + 40 mV
240 V	240.00000 V	100 µV	3.3 + 200 mV	0.4 + 150 mV	0.06 + 130 mV	0.30 + 200 mV	1.6 + 300 mV
330 V	330.00000 V	100 µV	3.3 + 200 mV	0.45 + 250 mV	0.09 + 230 mV	0.32 + 300 mV	1.6 + 400 mV

AC Current (true RMS)

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

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

[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
24 mV - 250 V	1 MΩ with < 300 pF	2 Hz - 300 kHz	0.5 s - 3.33 µs	5 1/2 digits	± 0.002% of reading

ACI Mode

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

Pulse Width

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

Threshold DAC

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

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 (SMX2064 and SM2064 only)

Capacitance

Accuracy ±(% of reading + farads) [1]

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

Inductance

Accuracy ± (% of reading + henrys)

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

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

Other measurement functions of SMX2064 and 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 Function (SMX2064 and SM2064 only)

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

Trigger Functions

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

General Specifications

- Overload Protection (voltage inputs): 330 VDC, 250 VAC
- Isolation: 330 VDC, 250 VAC 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°C to 65°C
- Storage Temperature: -40°C to 85°C
- Power requirements: +5 V, 300 mA maximum
- Dimensions (not including connectors):
  - · SMX2064/2060: 160 mm x 100 mm
  - · SM2064/2060: 208 mm x 112 mm
- Safety: Designed to IEC 1010-1, Installation Category II

Ordering Information

SMX2064
7-1/2 digits PXI Digital Multimeter with LCR Meter

SMX2060
7-1/2 digits PXI Digital Multimeter

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

SM2060
7-1/2 digits PCI Digital Multimeter