SMX2040, SM2040 Series

6-1/2 Digit Digital Multimeters

SMX2040

SM2040

Introduction

The SMX2040 and SM2040 series are 6-1/2 digit digital multimeters which provide a combination of resolution, accuracy, and speed that surpasses rivals. A 6-1/2 digit display, 0.0045% basic DCV accuracy and 1,000 readings per second assure accurate, fast, and repeatable measurements. The SMX2040 and SM2040 series is designed as a universal, multi-function DMM. Measurements commonly associated with "high-end" system DMMs are standard features with the SMX2040 and SM2040 family, such as 2-wire, 4-wire and 6-wire guarded resistance measurements, inductance and capacitance, leakage and temperature, RMS and peak-to-peak, frequency and timing, sourcing of voltage and current, and much more. The SMX2044 and SM2044 are best suited for applications demanding precision sources with simultaneous measurements such as in parametric testing, while the SMX2040 and SM2040 fit the bill where basic DMM functions are required, such as telecommunication, aerospace, automotive and education fields.

Features

- Flexible, full-featured auto-ranging DMM
- 6-1/2 digit resolution
- Up to 1,000 readings/second
- DC & AC Volts & Current, 2-Wire, 4-Wire Ohms
- True AC RMS measurements, 10 Hz to 100 kHz
- Measures 1 μV to 330 V
- Frequency Counter 1 Hz to 300 kHz
- Capacitance, Inductance, Leakage, 6-Wire Guarded Resis tance, Temperature measurements (SMX2042/2044, SM2042/2044)
- 330 V Isolation Barrier
- Self-Calibrating
- Plug-and-Play, Windows® 98/NT/2000/XP/2003
- Language support - Visual Basic, MSVisual C++, Delphi
- Package support - LabVIEW™, LabWindows/CVI,
- TestPoint, ATEasy, Matlab, VBA & more.

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]

Range	Full scale 6-1/2 Digits	Resolution	Input Resistance	24 hours 23°C±1°C	90 Days 23°C±5°C	One Year 23°C±5°C
330 mV	330.0000 mV	100 nV	>10 GΩ	0.003 + 4.5 μV	0.004 + 5.5 μV	0.007 + 8 μV
3.3 V	3.300000 V	1 μV	>10 GΩ	0.002 + 10 μV	0.0025 + 12 μV	0.0045 + 17 μV
33 V	33.00000 V	10 μV	10 MΩ	0.003 + 250 μV	0.004 + 280 μV	0.007 + 330 μV
330 V	330.0000 V	100 μV	10 MΩ	0.004 + 1 mV	0.005 + 1.2 mV	0.008 + 1.5 mV

[1] With reading rate set to 10 readings per second (rps) or slower, and within one hour of DCV zero, using relative control.

DC Current

Accuracy ± (% of reading + Amps) [1]

Range	Full scale 5-1/2 Digits	Resolution	Max Burden Voltage	24 hours 23°C±1°C	90 Days 23°C±5°C	One Year 23°C±5°C
3.3 mA	3.30000 mA	10 nA	350 mV	0.052 + 200 nA	0.07 + 350 nA	0.1 + 400 nA
33 mA	33.0000 mA	100 nA	350 mV	0.04 + 1 μA	0.06 + 2 μA	0.1 + 3 μA
330 mA	330.000 mA	1 μA	350 mV	0.05 + 30 μA	0.055 + 40 μA	0.075 + 60 μA
2.5 A	2.50000 A	10 μA	350 mV	0.55 + 50 μA	0.6 + 200 μA	0.65 + 350 μA

[1] With reading rate set to 10 rps or slower, and within one hour of DCI zero, using relative control.

2-Wire and 4-Wire Resistance

Accuracy ± (% of reading + Ω) [1]

Range [3]	Full scale 6-1/2 Digits	Resolution	Source Current	24 hours 23°C±1°C	90 Days 23°C±5°C	One Year 23°C±5°C
33 Ω[2]	33.00000 Ω	10 μΩ	10 mA	0.0038 + 1 mΩ	0.005 + 1.5 mΩ	0.008+ 2 mΩ
330 Ω	330.0000 Ω	100 μΩ	1 mA	0.0037 + 4.5 mΩ	0.0046 + 5 mΩ	0.007 + 6 mΩ
3.3 kΩ	3.300000 kΩ	1 mΩ	1 mA	0.0023 + 28 mΩ	0.004 + 32 mΩ	0.005 + 33 mΩ
33 kΩ	33.00000 kΩ	10 mΩ	100 μA	0.0025 + 300 mΩ	0.0033 + 330 mΩ	0.006 + 350 mΩ
330 kΩ	330.0000 kΩ	100 mΩ	10 μA	0.0055 + 3.2 Ω	0.007 + 4 Ω	0.009 + 5 Ω
3.3 MΩ	3.300000 MΩ	1 Ω	1 μA	0.018 + 40 Ω	0.03 + 50 Ω	0.04 + 70 Ω
33 MΩ	33.0000 MΩ	100 Ω	100 nA	0.12 + 400 Ω	0.13 + 500 Ω	0.2 + 600 Ω
330 MΩ[2]	330.00 MΩ	1 kΩ	10 nA	1 + 50 kΩ	1.4 + 60 kΩ	2.0 + 80 kΩ

[1] With reading rate set to 2 rps or slower, and within one hour of Ohms zero, using relative control.
[2] 33 Ω and 330 MΩ ranges are only available with the SMX2042, SMX2044, SM2042 and SM2044.
[3] 4-wire ohms is available up to the 330 kΩ range.

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 1 mA (SMX2044 and SM2044: 10 mA constant current plus variable current from 10 nA to 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 6-1/2 Digits	Resolution	10Hz - 20Hz	20Hz - 47Hz	47Hz - 10kHz	10kHz - 50kHz	50kHz-100kHz
330 mV	330.0000 mV	100 nV	3.2 + 430 μV	0.95 + 200 μV	0.15 + 120 μV	0.63 + 230 μV	5.6 + 400 μV
3.3 V	3.300000 V	1 μV	3.2 + 2.5 mV	1.0 + 1.7 mV	0.065 + 1.2 mV	0.70 + 1.5 mV	5.3 + 2 mV
33 V	33.00000 V	10 μV	3.3 + 20 mV	1.0 + 16 mV	0.073 + 13 mV	0.35 + 25 mV	2.4 + 40 mV
250 V	250.0000 V	100 μV	3.3 + 200 mV	1.0 + 150 mV	0.06 + 130 mV	0.45 + 200 mV	3.2 + 300 mV

AC Current (true RMS)

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

Range [3]	Full scale 6-1/2 Digits	Resolution	Max Burden Voltage (RMS)	10Hz - 20Hz[1]	20Hz - 47Hz[1]	47Hz - 1kHz[1]	1kHz -10kHz[1]
3.3 mA	3.300000 mA	1 nA	350 mV	2.9 + 4 μA	1.0 + 4 μA	0.12 + 4 μA	0.22 + 4 μA
33 mA	33.00000 mA	10 nA	350 mV	2.8 + 30 μA	1.0 + 30 μA	0.16 + 30 μA	0.4 + 40 μA
330 mA	330.0000 mA	100 nA	350 mV	2.8 + 400 μA	1.0 + 400 μA	0.22 + 220 μA	0.6 + 400 μA
2.5 A	2.500000 A	1 μA	350 mV	2.7 + 5 mA	0.9 + 6 mA	0.65 + 4 mA	0.7 + 5 mA

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

Time Functions (SMX2042, SMX2044, SM2042 and SM2044)

Frequency and Period

ACV Mode

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

ACI Mode

Input RMS Voltage 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)	1 Hz - 500 kHz	1 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	1 Hz to 100 kHz	2 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
330 mV	-1.0 V to +1.0 V	0.5 mV	1.900 V	0.2% + 4 mV
3.3 V	-10.0 V to +10.0 V	5.0 mV	19.00 V	0.2% + 40 mV
33 V	-100.0 V to +100.0 V	50 mV	190.0 V	0.2% + 0.4 V
250 V	-500 V to 500 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 (SMX2042, SMX2044, SM2042 and SM2044)

Capacitance

Accuracy ±(% of reading + farads) [1]

Range	Full scale Reading	Resolution	One Year 23°C±5°C
10 pF	11.999 nF	1 pF	2.1 ± 5 pF
100 nF	119.99 nF	10 nF	1.0
1 nF	1,199.9 pF	100 nF	1.0
10 μF	11.999 nF	1 μF	1.0
100 μF	119.99 nF	10 μF	1.0
1 mF	1.1999 μF	100 mF	1.2
10 mF	11.999 μF	1 mF	2

[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 10 nF range, which measures down to 0 pF.

Inductance (SM2044 and SMX2044 only)

Accuracy ±(% of reading + farads) [1]

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

[1] Within one hour of zero, and Open Terminal Calibration. Accuracy is specified for values greater than 5% of the selected range.

Other measurement functions of the SMX2044 and SM2044: 6-wire guarded resistance, AC peak-to-peak voltage, AC crest factor, AC median value, leakage current, RTD temperature, in circuit AC-based capacitance

Source Functions (SMX2044 and SM2044 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: 50 mV to 7.1 VRMS
  - · DAC resolution: 16 bits (closed loop), 12 bits (open loop)
  - · Frequency range/resolution: 2 Hz to 75 kHz/ 2 Hz
- 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: High: +3 V to +15 V, Low: -15 V to +0.8 V
  - · Trigger high current drive: Min. 1 mA, Max 10 mA (TTL or CMOS logic level)
- PXI Bus Hardware Trigger Inputs (at PXI J2)
  - · Trigger Input: TTL or CMOS positive pulse
  - · Trigger Pulse Width: Minimum 250 μs
- PXI Bus Hardware Trigger Outputs (to PXI J2)
  - · Trigger Output: TTL or CMOS negative pulse. Positive edge = ready
  - · Trigger Pulse Width: Approximately 140 μs
- Analog Threshold Trigger
  - · Captures up to 64 post-trigger readings
  - · Reading rate: 10 rps or higher

General Specifications

- Reading Rate (user selectable):
  - · 0.5 to 1,000 readings per second (rps)
  - · Up to 10 rps, 6 1/2 digits
  - · Up to 30 rps, 5 1/2 digits
- Overload Protection (voltage inputs): 330 V_{DC}, 250 V_{AC}
- Isolation: 330 V_{DC}, 250 V_{AC} from Earth Ground
- Maximum Input (Volt x Hertz):
  - · $8x10^6$ Volt x Hz normal mode input
  - · $1x10^6$ Volt x Hz common mode input
- Calibration: Calibrations are performed by Signametrics in a computer at a 3°C internal temperature rise. All calibration constants are stored in a text file.
- Operating Temperature: -10°C to 70°C
- Storage Temperature: -65°C to 85°C
- Power requirements: +5 volts, 300 mA maximum
- Dimensions (not including connectors):
  - · SMX2040 series: 160 mm x 100 mm
  - · SM2040 series: 208 mm x 112 mm
- Safety: Designed to IEC 1010-1, Installation Category II

Ordering Information

SMX2044
6-1/2 digits PXI LCR Sourcing Digital Multimeter

SMX2042
6-1/2 digits PXI Multi-Function Digital Multimeter

SMX2040
6-1/2 digits PXI Digital Multimeter

SM2044
6-1/2 digits PCI LCR Sourcing Digital Multimeter

SM2042
6-1/2 digits PCI Multi-Function Digital Multimeter

SM2040
6-1/2 digits PCI Digital Multimeter