SM2040 Series

6-½ Digit PXI Digital Multimeter

Features

- Flexible, full-featured auto-ranging DMM
- 6-½ digit resolution
- Up to 1,000 readings/second
- DC & AC Volts & Current, 2-Wire, 4-Wire Ohms
- True AC RMS measurements, 10Hz to 100kHz
- Measure 1µV to 330V
- Frequency Counter 1Hz to 300 kHz
- Capacitance, Inductance, Leakage, 6-Wire Guarded Resistance, Temperature measurements (SMX2042/2044)
- 330V Isolation Barrier
- Self-Calibrating
- Plug-and-Play, Windows® 95/98/Me/NT/2000/XP
- 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

Introduction

The SMX2040 series is a PXI 6-½ digit Digital Multimeter which provides a combination of resolution, accuracy, and speed that surpasses rivals. A 6-½ digit display, 0.0045% basic DCV accuracy and 1,000 readings per second assure accurate, fast, and repeatable measurements. The SMX2040 series is designed as a universal, multifunctional DMM. Measurements commonly associated with "high-end" system DMMs are standard features with the SMX2040 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 is best suited for applications demanding precision sources with simultaneous measurements such as in Parametric testing, while the SMX2040 fits the bill where basic DMM functions are required, such as telecommunication, aerospace, automotive and education fields.

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 6-½ Digits	Resolution	Input Resistance	24 hours 23˚C±1˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
330mV	330.0000 mV	100nV	>10GΩ	0.003 + 4.5µV	0.004 + 5.5µV	0.007 + 8µV
3.3V	3.300000 V	1µV	>10GΩ	0.002 + 10µV	0.0025 + 12µV	0.0045 + 17µV
33V	33.00000 V	10µV	10MΩ	0.003 + 250µV	0.004 + 280µV	0.007 + 330µV
330V	330.0000 V	100µV	10MΩ	0.004 + 1mV	0.005 + 1.2mV	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 5-½ Digits	Resolution	Max Burden Voltage	24 hours 23˚C±1˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
3.3mA	3.30000mA	10nA	350mV	0.052 + 200nA	0.07 + 350nA	0.1 + 400nA
33mA	33.0000mA	100nA	350mV	0.04 + 1µA	0.06 + 2µA	0.1 + 3µA
330mA	330.000mA	1µA	350mV	0.05 + 30µA	0.055 + 40µA	0.075 + 60µA
2.5A	2.50000A	10µA	350mV	0.55 + 50µA	0.6 + 200µA	0.65 + 350µA

[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 6-½ Digits	Resolution	Source Current	24 hours 23˚C±1˚C	90 Days 23˚C±5˚C	One Year 23˚C±5˚C
33Ω[2]	33.00000Ω	10µΩ	10mA	0.0038 + 1mΩ	0.005 + 1.5mΩ	0.008+ 2mΩ
330Ω	330.0000Ω	100µΩ	1mA	0.0037 + 4.5mΩ	0.0046 + 5mΩ	0.007 + 6mΩ
3.3kΩ	3.300000kΩ	1mΩ	1mA	0.0023 + 28mΩ	0.004 + 32mΩ	0.005 + 33mΩ
33kΩ	33.00000kΩ	10mΩ	100µA	0.0025 + 300mΩ	0.0033 + 330mΩ	0.006 + 350mΩ
330kΩ	330.0000kΩ	100mΩ	10µA	0.0055 + 3.2Ω	0.007 + 4Ω	0.009 + 5Ω
3.3MΩ	3.300000MΩ	1Ω	1µA	0.018 + 40Ω	0.03 + 50Ω	0.04 + 70Ω
33MΩ	33.0000MΩ	100Ω	100nA	0.12 + 400Ω	0.13 + 500Ω	0.2 + 600Ω
330MΩ[2]	330.00MΩ	1kΩ	10nA	1 + 50kΩ	1.4 + 60kΩ	2.0 + 80kΩ

[1] With reading rate set to 2 rps or slower, and within one hour of Ohms zero, using relative control.
[2] 33Ω and 330MΩ ranges are only available with the SMX2042, 2044.
[3] 4-wire ohms is available up to the 330kΩ range.

Diode Characterization

Maximum Diode Voltage Compliance	Available DC current Uncertainty	Typical Current Value	Typical Voltage Value Uncertainty
4V	100nA, 1µA, 10µA, 100µA and 1mA (SMX2044: 10mA constant current plus variable current from 10nA to 12.5mA)	1%	0.02%

AC Functions

AC Voltage (true RMS)

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

Range	Full scale 6-½ Digits	Resolution	10Hz - 20Hz	20Hz - 47Hz	47Hz - 10kHz	10kHz - 50kHz	50kHz-100kHz
330mV	330.0000mV	100nV	3.2 + 430µV	0.95 + 200µV	0.15 + 120µV	0.63 + 230µV	5.6 + 400µV
3.3V	3.300000V	1µV	3.2 + 2.5mV	1.0 + 1.7mV	0.065 + 1.2mV	0.70 + 1.5mV	5.3 + 2mV
33V	33.00000V	10µV	3.3 + 20mV	1.0 + 16mV	0.073 + 13mV	0.35 + 25mV	2.4 + 40mV
250V	250.0000V	100µV	3.3 + 200mV	1.0 + 150mV	0.06 + 130mV	0.45 + 200mV	3.2 + 300mV

AC Current (true RMS)

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

Range	Full scale 6-½ Digits	Resolution	Max Burden Voltage (RMS)	10Hz - 20Hz[1]	20Hz - 47Hz[1]	47Hz - 1kHz[1]	1kHz - 10kHz[1]
3.3mA	3.300000mA	1nA	350mV	2.9 + 4µA	1.0 + 4µA	0.12 + 4µA	0.22 + 4µA
33mA	33.00000mA	10nA	350mV	2.8 + 30µA	1.0 + 30µA	0.16 + 30µA	0.4 + 40µA
330mA	330.0000mA	100nA	350mV	2.8 + 400µA	1.0 + 400µA	0.22 + 220µA	0.6 + 400µA
2.5A	2.500000A	1µA	350mV	2.7 + 5mA	0.9 + 6mA	0.65 + 4mA	0.7 + 5mA

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

Time Functions (SM2042, 44)

Frequency and Period

ACV Mode

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

ACI Mode

Input RMS Voltage range	Input Impedance	Frequency Range	Period Range	Resolution	Uncertainty
0.33mA - 2.5A	10Ω (3mA & 30mA) 0.1Ω (330mA & 2.5A)	1Hz - 500kHz	1 s - 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	1Hz to 100kHz	2µs	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
330mV	-1.0V to +1.0V	0.5mV	1.900 V	0.2% + 4mV
3.3V	-10.0V to +10.0V	5.0mV	19.00V	0.2% + 40mV
33V	-100.0V to +100.0V	50mV	190.0V	0.2% + 0.4V
250V	-500V to +500V	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 (SMX2042, 44)

Capacitance

Accuracy ± (% of reading + farads) [1]

Range	Full scale Reading	Resolution	One Year 23˚C±5˚C
10nF	11.999nF	1pF	2.1 ± 5pF
100nF	119.99nF	10pF	1.0
1µF	1.1999µF	100pF	1.0
10µF	11.999µF	1nF	1.0
100µF	119.99µF	10nF	1.0
1mF	1.1999mF	100nF	1.2
10mF	11.999mF	1µF	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 10nF range, which measures down to 0pF.

Inductance (SM2044 only)

Accuracy ±(% of reading + henrys)

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

[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: 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 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: 50mV to 7.1V_{RMS}
  - 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: 1.25µA to 12.5mA

Trigger Functions

- External Hardware Trigger (at DIN-7 connector)
  - Trigger input voltage level range: High: +3V to +15V, Low: -15V to +0.8V
  - Trigger high current drive: Min. 1 mA, Max 10mA (TTL or CMOS logic level)
- PXI Bus Hardware Trigger Inputs (at PXI J2)
  - Trigger Input: TTL or CMOS positive pulse
  - Trigger Pulse Width: Minimum 250µs
- PXI Bus Hardware Trigger Outputs (to PXI J2)
  - Trigger Output: TTL or CMOS negative pulse. Positive edge = ready
  - Trigger Pulse Width: Approximately 140µs
- 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): 330V_{DC}, 250V_{AC}
- Isolation: 330V_{DC}, 250V_{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 to 70˚C
- Storage Temperature: -65 to 85˚C
- Power requirements: +5 volts, 300mA maximum
- Dimensions (not including connectors): 160mm x 100mm
- 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 Multifunction Digital Multimeter
- **SMX2040**
  6-1/2 digits PXI Digital Multimeter