

Racal Instruments™ 4102

Source/Measure 7.5 Digit Versa-Multimeter

Product
Information

The Racal Instruments™ 4102 Versa-Multimeter combines high-speed 7.5 digit measurement capability with a high-precision, programmable source extending a wide range of measurement possibilities to up to 512 switching channels.

Connectivity Made Simple

The 4102 Versa-Multimeter has internal connections to the 1830's multi-lane signal raceway. When combined with one or more switch modules such as the 1380 Multiplexer or the 1450 Matrix plug-in modules, the 4102 can connect to any one of up to 500-plus channels.



High-Speed, High-Throughput Scanning

The 4102 DMM option for the 1800 Series Source/Measure Switch, combined with one or more 1380 Multiplexer plug-in modules, enables high-speed scanning of multiple inputs into the DMM.

Up to four 4102s can be installed in a single 1830 system for simultaneously measuring up to four

inputs for a 4x improvement in throughput.

DMM Measurement Capabilities

The 4102 features high-resolution measurements and is useful for most measurement applications where speed and accuracy are important. Available measurements include:

- AC/DC Voltage
- AC/DC Current
- Two/Four/Six Wire Ohms
- Frequency/Period
- Temperature (4-W RTD/ Thermocouple)
- Diode I-V Characterization

Offset Compensation for Critical Resistance Measurements

The 4102 features offset compensation to eliminate the effect of small series voltages for critical resistance measurements. Inadvertent parasitic leakage currents, thermo-voltaic voltages, and other voltages in series introduce errors into resistance measurements. The DMM supplies a fixed current

Key Highlights

- Factory-installed option for the Racal Instruments™ model 1830 Source/Measure Switch System
- 7.5 Digit AC and DC Current and Voltage plus 2/4/6 Wire Ohms with Offset Compensation
- Automatic Inductance, Capacitance, ESR, Diode, Temperature (RTD or T/C), and Leakage Measurement
- Built-in Precision Source Provides AC and DC Voltage and DC Current
- Test Scripting and Programmable Aperture for High Throughput Testing
- Optional ActivATE Test Platform for High-Speed Test Program Development

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through the unknown resistance and measures the voltage drop. With offset compensation activated and the DMM internal current source set to zero, the DMM again measures the voltage drop across the unknown resistance. The error is calculated by the DMM and eliminated from the final reading.

Component Test/Characterization

The 4102 automatically characterizes diodes, measures leakages, and measures capacitances (AC and DC methods for in-circuit versus speed optimization), ESR, and inductances. Source voltages and currents are kept as low as possible to avoid damage to sensitive semiconductor devices during in-circuit test.

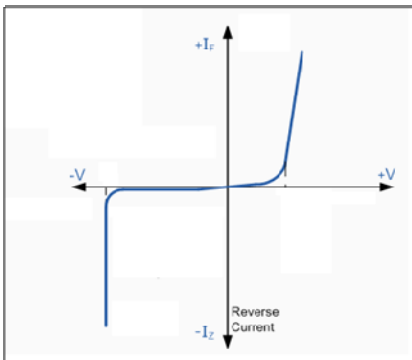


Figure 1: Diode I-V Curve

Scalable Performance

As test throughput requirements change, you can scale measurement throughput by adding up to four 4102 versa-multimeters into an 1830 Source/Measure Switch system. Having multiple units can be used to reduce the amount of function or range changes required or just to double, triple, or quadruple raw measurement speed.



Figure 2: 4102 Front Panel

Web Page Control

The 4102 Versa-Multimeter has a full-featured web page interface when used in LXI control mode. The web page DMM interface allows you to interact with the DMM settings and to make and plot multiple measurements.

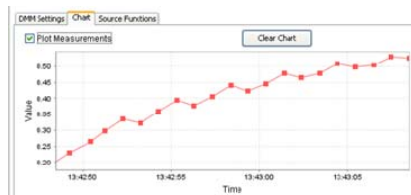


Figure 3: 4102 Web Page Chart

Built-in Programmable Source

The 4102 has built-in programmable AC and DC voltage sources, a DC current source. These sources are isolated and useful as high-accuracy test stimuli, especially in conjunction with simultaneous DMM measurements. This makes the instrument particularly useful for measuring strain bridges, pressure gauges, RTDs, load cells, or thermistors.

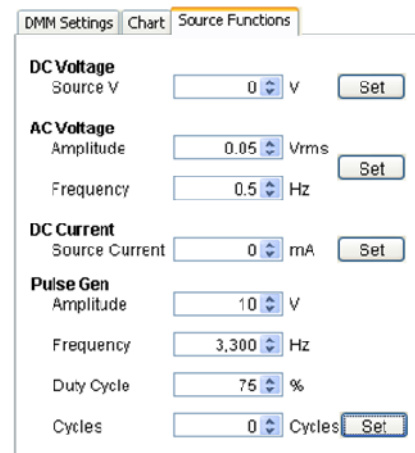


Figure 4: 4102 Source Web Controls

Test Sequencing

The optional ActivATE™ Test Platform provides instrument drivers, interactive control panels

Key Points

- The 4102 Versa-Multimeter combines high-speed 7.5 digit measurement capability with a high-precision, programmable source extending a wide range of measurement possibilities to up to 512 switching channels.
- The 4102 Versa-Multimeter has internal connections to the 1830's multi-lane signal raceway.
- When combined with one or more switch modules such as the 1380 Multiplexer or the 1450 Matrix plug-in modules, the 4102 can connect to any one of up to 500-plus channels.
- The 4102 DMM option for the 1800 Series Source/Measure Switch, combined with one or more 1380 Multiplexer plug-in modules, enables high-speed scanning of multiple inputs into the DMM.

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(update during test program execution), a test routine debug/development environment for the Visual Basic® development system (full and script) and C# languages with an integrated sequencer included. Harnessing the programming power of the Microsoft .NET™ framework, the ActivATE™ Test Platform is sure to boost the productivity of test program developers.

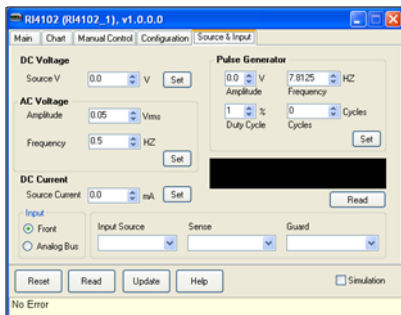


Figure 5: ActivATE Controls for 4102

Automatic Scanning

The 4102, when installed in an 1800 series chassis from EADS North America Test and Services, can be connected to multiple test points for temperature, strain, voltage, or current scanning and more. The 1830 backplane uses a signal raceway to make the connections with no external wiring required. This simplifies test development while it reduces external cabling and the overall length of cable that a signal must pass through on its way to being measured.

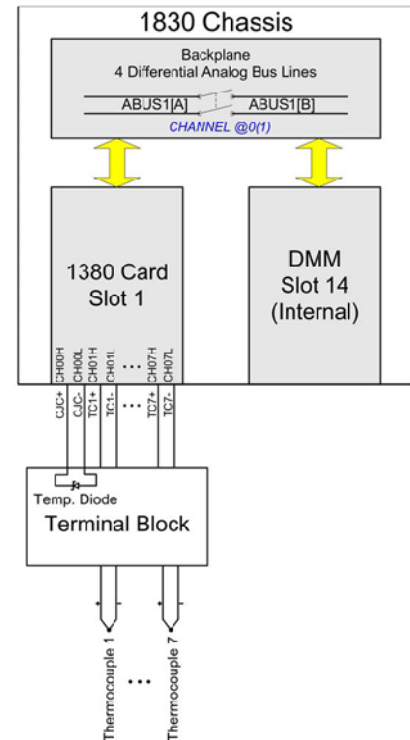


Figure 6: Thermocouple Scan Diagram

Key Points

- Up to four 4102s can be installed in a single 1830 system for simultaneously measuring up to four inputs for a 4x improvement in throughput.
- The 4102 features high-resolution measurements and is useful for most measurement applications where speed and accuracy are important.
- The 4102 features offset compensation to eliminate the effect of small series voltages for critical resistance measurements.
- Inadvertent parasitic leakage currents, thermo-voltaic voltages, and other voltages in series introduce errors into resistance measurements. The DMM supplies a fixed current through the unknown resistance and measures the voltage drop. With offset compensation activated and the DMM internal current source set to zero, the DMM again measures the voltage drop

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Product Information—Specifications

4102 Measurement Accuracy $\pm$ (% of reading + % of range) Note: Accuracy is at DMM terminals.

Function	Range	Frequency, burden voltage, test current	24 hour 23°C $\pm$ 1°C	90 days 23°C $\pm$ 5°C	1 year 23°C $\pm$ 5°C	Temperature Coefficient 23°C $\pm$ 5°C
DC Volts ²	240.00000 mV	10 nV resolution	0.003+0.0004	0.004+0.0006	0.005+0.0008	0.0005+0.00008
	2.4000000 V	100 nV	0.002+0.0001	0.0025+0.0002	0.003+0.0002	0.0003+0.00002
	24.000000 V	1 μ V	0.004+0.0005	0.005+0.0005	0.006+0.0006	0.0006+0.00006
	240.00000 V	10 μ V	0.003+0.0001	0.004+0.0001	0.005+0.0002	0.0005+0.00002
	300.00000 V	10 μ V	0.0075+0.0002	0.01+0.0002	0.015+0.0003	0.0015+0.00003
True RMS AC Voltage ^{4,5}	240.00000 mV	10-20 Hz	3.0+0.04	3.1+0.06	3.2+0.08	0.32+0.008
	to	20-47 Hz	0.37+0.01	0.38+0.02	0.4+0.02	0.04+0.002
	240.00000 V	47Hz-10 kHz	0.13+0.05	0.14+0.05	0.15+0.06	0.015+0.006
		10-50 kHz	0.25+0.01	0.26+0.01	0.27+0.02	0.027+0.002
		50-100 kHz	1.9+0.02	1.95+0.02	2.0+0.02	0.2+0.002
	300.00000 V	10-20 Hz	3.0+0.07	3.1+0.05	3.2+0.07	0.32+0.007
		20-47 Hz	0.37+0.06	0.38+0.07	0.4+0.08	0.04+0.008
		47Hz-10 kHz	0.13+0.05	0.14+0.07	0.15+0.08	0.015+0.008
		10-50 kHz	0.25+0.07	0.26+0.08	0.27+0.1	0.027+0.01
		50-100 kHz	1.9+0.09	1.95+0.12	2.0+0.13	0.2+0.013
Resistance ²	24.000000 Ω ¹	10 mA test current	0.0038+0.0058	0.005+0.0067	0.006+0.0083	0.0006+0.00083
	240.00000 Ω	1 mA	0.0037+0.0019	0.004+0.0021	0.005+0.0025	0.0005+0.00025
	2.4000000 k Ω	1 mA	0.0023+0.0012	0.0025+0.0013	0.003+0.0014	0.0003+0.00014
	24.000000 k Ω	100 μ A	0.0025+0.0013	0.005+0.0014	0.006+0.0015	0.0006+0.00015
	240.00000 k Ω	10 μ A	0.0055+0.0013	0.004+0.0017	0.005+0.0021	0.0005+0.00021
	2.4000000 M Ω	1 μ A	0.018+0.0017	0.0025+0.0021	0.003+0.0029	0.0003+0.00029
	24.0000 M Ω	100 nA	0.12+0.0017	0.005+0.0021	0.006+0.0025	0.0006+0.00025
	240.000 M Ω ¹	10 nA	0.8+0.008	0.004+0.013	0.005+0.021	0.0005+0.0021
DC Current ³	240.0000 nA ¹	<100 mV burden	0.07+0.017	0.1+0.019	0.17+0.025	0.017+0.0025
	2.400000 μ A ¹	<100 mV	0.05+0.003	0.08+0.004	0.21+0.006	0.021+0.0006
	24.00000 μ A ¹	<100 mV	0.05+0.002	0.08+0.003	0.13+0.003	0.013+0.0003
	240.000 μ A ¹	<2.5 mV	0.052+0.0083	0.07+0.125	0.1+0.167	0.01+0.0167
	2.40000 mA	<25 mV	0.05+0.013	0.06+0.017	0.07+0.023	0.007+0.0023
	24.0000 mA	<250 mV	0.05+0.001	0.065+0.002	0.08+0.002	0.008+0.0002
	240.000 mA	<55 mV	0.05+0.021	0.055+0.025	0.065+0.033	0.0065+0.0033
	2.40000 A	<520 mV	0.3+0.025	0.4+0.029	0.45+0.038	0.045+0.0038

Chart continued on next page

Key Points—continued

across the unknown resistance. The error is calculated by the DMM and eliminated from the final reading.

- The 4102 automatically characterizes diodes, measures leakages, and measures capacitances (AC and DC methods for in-circuit versus speed optimization), ESR, and inductances.

- As test throughput requirements change, you can scale measurement throughput by adding up to four 4102 versa-multimeters into an 1830 Source/Measure Switch system.
- Having multiple units can be used to reduce the amount of function or range changes required or just to double, triple, or quad-ruple raw measurement speed.
- The 4102 Versa-Multimeter has a full-featured web page interface when used in LXI control mode.

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4102 Measurement Accuracy $\pm$ (% of reading + % of range) Note: Accuracy is at DMM terminals.

Function	Range	Frequency, burden voltage, test current	24 hour 23°C $\pm$ 1°C	90 days 23°C $\pm$ 5°C	1 year 23°C $\pm$ 5°C	Temperature Coefficient 23°C $\pm$ 5°C
True RMS AC Current ⁶	2.400000 μ A ($>60 \mu$ A)	10-20 Hz	1.8+0.17	2.7+0.17	3.2+0.17	0.32+0.017
		20-47 Hz	0.9+0.17	0.9+0.17	0.4+0.17	0.04+0.017
		47Hz-1 kHz	0.04+0.063	0.08+0.13	0.15+0.17	0.015+0.017
		1-10 kHz	0.12+0.17	0.14+0.17	0.27+0.17	0.027+0.017
	24.00000 μ A ($>300 \mu$ A)	10-20 Hz	1.8+0.13	2.6+0.13	2.8+0.13	0.28+0.013
		20-47 Hz	0.6+0.13	0.9+0.13	1.0+0.13	0.1+0.013
		47Hz-1 kHz	0.07+0.083	0.15+0.083	0.16+0.13	0.016+0.013
		1-10 kHz	0.21+0.17	0.3+0.17	0.4+0.17	0.04+0.017
	240.0000 mA (>3 mA)	10-20 Hz	1.8+0.17	2.7+0.17	2.8+0.17	0.28+0.017
		20-47 Hz	0.6+0.17	0.9+0.17	1.0+0.17	0.1+0.017
		47Hz-1 kHz	0.1+0.042	0.17+0.075	0.2+0.092	0.02+0.0092
		1-10 kHz	0.3+0.13	0.35+0.15	0.4+0.17	0.04+0.017
	2.400000 A (>30 mA)	10-20 Hz	1.8+0.19	2.5+0.19	2.7+0.21	0.27+0.021
		20-47 Hz	0.66+0.19	0.8+0.19	0.9+0.25	0.09+0.025
		47Hz-1 kHz	0.3+0.16	0.33+0.16	0.35+0.17	0.035+0.017
		1-10 kHz	0.4+0.19	0.45+0.19	0.5+0.21	0.05+0.021
Frequency and Period	240 mV to 300V	2 Hz - 100 Hz	0.002 + 0.004	0.002 + 0.004	0.002 + 0.004	0.0002 + 0.0004
		100 Hz-1 kHz	0.002 + 0.002	0.002 + 0.002	0.002 + 0.002	0.0002 + 0.0002
		1 kHz-10 kHz	0.002 + 0.002	0.002 + 0.002	0.002 + 0.002	0.0002 + 0.0002
		10 kHz-100 kHz	0.002 + 0.002	0.002 + 0.002	0.002 + 0.002	0.0002 + 0.0002
		100 kHz-300 kHz	0.002 + 0.0017	0.002 + 0.0017	0.002 + 0.0017	0.0002 + 0.00017

Notes:

1. To obtain the specified accuracies, allow 30 minutes of warm-up.
2. Accuracies are with aperture set to ≥ 0.5 s, and within one hour from self-calibration.
3. Accuracies are with aperture set to ≥ 0.96 s, and within one hour from self-calibration (relative control).
4. Between 5 mV and 10 mV, add 100 μ V of additional error.
5. Signal is limited to 8x106 Volt-Hz product. For example, the largest frequency input at 250 V is 32 kHz.
6. All AC current ranges have typical measurement capability of at least 20 kHz.

Key Points—continued

- The web page DMM interface allows you to interact with the DMM settings and to make and plot multiple measurements.
- The 4102 has built-in programmable AC and DC voltage sources, a DC current source.
- These sources are isolated and useful as high-accuracy test

stimuli, especially in conjunction with simultaneous DMM measurements. This makes the instrument particularly useful for measuring strain bridges, pressure gauges, RTDs, load cells, or thermistors.

- The optional ActivATE™ Test Platform provides instrument drivers, interactive control panels (update during test program execution), a test routine debug/development environment for the Visual Basic® development system (full and script) and C#

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4102 Measurement Accuracy $\pm$ (% of reading + % of range) Note: Accuracy is at DMM terminals.

Function	Range	Frequency, burden voltage, test current	Resolution	Full Scale of Range	1 year 23°C $\pm$ 5°C	Temperature Coefficient 23°C $\pm$ 5°C
AC peak to peak Voltage	240 mV	30Hz-60 kHz	1 mV	1.9 Vp-p	0.5+1.25	0.05+0.125
	2.4 V	30Hz-60 kHz	10 mV	16 Vp-p	0.5+1.67	0.05+0.167
	24 V	30Hz-60 kHz	100 mV	190 Vp-p	0.5+2.92	0.05+0.292
	240 V	30Hz-60 kHz	1 V	848 Vp-p	0.55+2.5	0.055+0.25
AC Crest Factor ¹	240 mV	30Hz-60 kHz	0.01	1.9 Vp-p	2.2+0.3	0.22+0.03
	2.4 V	30Hz-60 kHz	0.01	16 Vp-p	2.1+0.1	0.21+0.01
	24 V	30Hz-60 kHz	0.01	190 Vp-p	2.0+0.1	0.2+0.01
	240 V	30Hz-60 kHz	0.01	700 Vp-p	2.0+0.1	0.2+0.01
	300 V	30Hz-60 kHz	0.01	848 Vp-p	2.0+0.1	0.2+0.01
AC Median Value	240 mV	30Hz-30 kHz	1 mV	± 0.95 V	2+1.8	0.2+0.18
	2.4 V	30Hz-30 kHz	10 mV	± 9.5 V	3+1.7	0.3+0.17
	24 V	30Hz-30 kHz	100 mV	± 95.0 V	3+1.5	0.3+0.15
	240 V	30Hz-30 kHz	1 V	± 300.0 V	3+3.43	0.3+0.343
	300 V	30Hz-30 kHz	1 V	± 300.0 V	3+4	0.3+0.4
Resistance (6-wire Guarded) ²	24.000000 Ω	20 mA I _{max} guard		24 Ω	0.306+0.025	0.0306+0.0025
	240.00000 Ω	20 mA		240 Ω	0.008+0.0855	0.0008+0.00855
	2.4000000 k Ω	20 mA		2.4 k Ω	0.008+0.0056	0.0008+0.00056
	24.000000 k Ω	100 μ A		24 k Ω	0.036+0.0057	0.0036+0.00057
	240.00000 k Ω	10 μ A		240 k Ω	0.355+0.0063	0.0355+0.00063
	24.0000 M Ω	1 μ A		24 M Ω	0.856+0.0067	0.0856+0.00067
Resistance (Extended) ^{3,4,5}	400.00 k Ω	25 μ A current limit	10 Ω	0.2 + 0.0125	0.33+0.0225	0.033+0.00225
	4.00000 M Ω	2.5 μ A	100 Ω	0.3 + 0.0088	0.43+0.0138	0.043+0.00138
	2.4000000 k Ω	250 nA	1 k Ω	0.4 + 0.0075	0.55+0.0113	0.055+0.00113
Leakage Measurement ³	240.0000 nA	<100 μ V burden	0.07+0.017	0.1+0.019	0.17+0.025	0.017+0.0025
	2.400000 μ A	<100 μ V	0.05+0.003	0.08+0.004	0.21+0.006	0.021+0.0006
	24.000000 μ A	<100 μ V	0.05+0.002	0.08+0.003	0.13+0.003	0.013+0.0003
Trigger Level Threshold	240 mV	1.900 V max Vp-p	0.5 mV	-1.0 V to +1.0 V	0.2+0.4	0.02+0.04
	2.4 V	19.00 V	5.0 mV	-10.0 V to +10.0 V	0.2+0.4	0.02+0.04
	24 V	190.0 V	50 mV	-100.0 V to 100.0 V	0.2+0.4	0.02+0.04
	240 V	848.0 V	500 mV	-400 V to 400 V	0.2+1.0	0.02+0.1

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Key Points—continued

languages with an integrated sequencer included.

- Harnessing the programming power of the Microsoft .NET™ framework, the ActivATE™ Test Platform is sure to boost the productivity of test program developers.
- The 4102, when installed in an 1800 series chassis, can be connected to multiple test points for temperature, strain,

voltage, or current scanning and more.

- The 1830 backplane uses a signal raceway to make the connections with no external wiring required. This simplifies test development while it reduces external cabling and the overall length of cable that a signal must pass through on its way to being measured.

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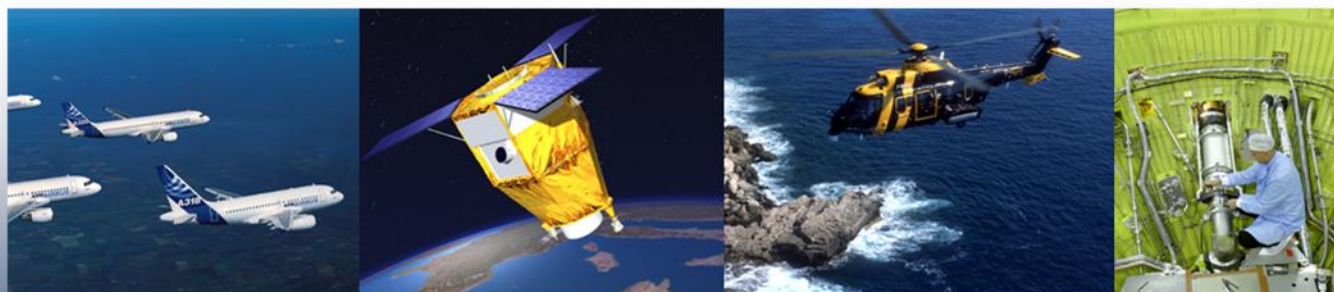
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4102 Measurement Accuracy $\pm$ (% of reading + % of range) Note: Accuracy is at DMM terminals.

Function	Range	Frequency, burden voltage, test current	Resolution	Full Scale of Range	1 year 23°C $\pm$ 5°C	Temperature Coefficient 23°C $\pm$ >5°C
Duty Cycle Measurement	240 mV to 300 V	2 Hz - 100 Hz	0.02%	100.00%	0.03+0.03	0.003+0.003
		100 Hz-1 kHz	0.2%	100.00%	0.03+0.3	0.003+0.03
		1 kHz-10 kHz	2%	100.00%	0.03+3	0.003+0.3
		10 kHz-100 kHz	20%	100.00%	0.03+20	0.003+2
Pulse Width	240 mV to 300 V	0.5 Hz - 100 kHz ⁶	1 μ s	2 μ s - 1 s	0.01 + 0.004	0.001 + 0.0004
Totalize	1 to 10 ⁹ events	Programmable trigger level and slope	1 event	1 to 30 k events per second		
Inductance ^{7,8}	33 μ H	100 kHz test freq.	1 nH	33.000 μ H	3.0+1.52	0.3+0.152
	330 μ H	50 kHz	10 nH	330.00 μ H	2.0+0.91	0.2+0.091
	3.3 mH	4 kHz	100 nH	3.3000 mH	1.5+0.76	0.15+0.076
	33 mH	1.5 kHz	1 μ H	33.000 mH	1.5+0.61	0.15+0.061
	330 mH	1 kHz	10 μ H	330.00 mH	2.5+0.91	0.25+0.091
	3.3 H	100 Hz	100 μ H	3.3000 H	3+1.1	0.3+0.11
Diode I-V Test	2.4V	Test current: 100 nA to 1 mA	100 nV	0 V to 2.4 V	0.01+0.002	0.001+0.0002

Notes:

1. Repetitive signal; frequency range of 30 Hz to 60 kHz
2. Accuracies are with aperture set to ≥ 0.5 s, and within one hour from self-calibration.
3. Accuracies are with aperture set to ≥ 0.5 s, and within one hour from zero (relative control).
4. Multiply “% of reading” by 1/Voltage Source for applied voltages below 1V
5. Limit is reached when the test current exceeds the Current Limit or if it is below 0.04% of this value
6. Pulse width frequencies below 2 Hz are achieved by taking 1/ period of (positive PW + negative PW)
7. Within one hour of Zero, and Open Terminal Calibration.
8. Accuracy is specified for values greater than 5% of the selected range.



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4101 Measurement Accuracy $\pm$ (% of reading + % of range) Note: Accuracy is at DMM terminals.

Function	Range or Device Type	Frequency, burden voltage, test current	Resolution	Full Scale of Range	1 year 23°C $\pm$ 5°C	Temperature Coefficient 23°C $\pm$ 5°C
Capacitance (Multi-Slope Charge Balance Method) ^{1,2,3}	1,200 pF	> 5% of range	0.1 pF	1,199.9 pF	1+0.083	0.1+0.0083
	12 nF		1 pF	11.999 nF	1.2+0.042	0.12+0.0042
	120 nF		10 pF	119.99 nF	1.0+0.002	0.1+0.0002
	1.2 μ F		100 pF	1.1999 μ F	1.0+0.0002	0.1+0.00002
	12 μ F		1 nF	11.999 μ F	1	0.1
	120 μ F		10 nF	119.99 μ F	1	0.1
	1.2 mF		100 nF	1.1999 mF	1.2	0.12
	12 mF		1 μ F	50.000 mF	2	0.2
Capacitance (In-Circuit Method) ^{4,5}	24 nF	> 5% of range	10 pF	23.99 nF	5+0.83 ⁵	0.5+0.083
	240 nF	> 5%	100 pF	239.9 nF	5+0.42 ⁵	0.5+0.042
	2.4 μ F	> 5%	1000 pF	2.399 μ F	3+0.21 ⁶	0.3+0.021
	24 μ F	> 5%	10 nF	23.99 μ F	3+0.21 ⁶	0.3+0.021
	240 μ F	> 5%	100 nF	239.9 μ F	3+0.21 ⁶	0.3+0.021
	2.4 mF	> 5%	1 μ F	2.399 mF	3+0.21 ⁶	0.3+0.021
RTD Temperature ⁶	pt385, pt3911, pt3916, pt3926	Ro = 100 or 200 Ω	0.01°C	-150 to 650°C	$\pm 0.06^\circ\text{C}$	$\pm 0.006^\circ\text{C}$
	pt385, pt3911, pt3916, pt3926	Ro = 500 or 1 k Ω	0.01°C	-150 to 650°C	$\pm 0.03^\circ\text{C}$	$\pm 0.003^\circ\text{C}$
	Cu (Copper)	< 12 Ω	0.01°C	-100 to 200°C	$\pm 0.18^\circ\text{C} \leq 20^\circ\text{C}$ $\pm 0.05^\circ\text{C}$ otherwise	$\pm 0.018^\circ\text{C} \leq 20^\circ\text{C}$ $\pm 0.005^\circ\text{C}$ otherwise
	Cu (Copper)	> 90 Ω	0.01°C	-100 to 200°C	$\pm 0.10^\circ\text{C} \leq 20^\circ\text{C}$ $\pm 0.05^\circ\text{C}$ otherwise	$\pm 0.01^\circ\text{C} \leq 20^\circ\text{C}$ $\pm 0.005^\circ\text{C}$ otherwise
Thermocouple Temperature ^{7,8}	B	0°C-50°C cold junction temperature range. Cold junction compensation is available by sensor measurement or soft entry.	0.01°C	2200°C	$\pm 0.38^\circ\text{C}$	$\pm 0.038^\circ\text{C}$
	E		0.01°C	1200°C	$\pm 0.035^\circ\text{C}$	$\pm 0.0035^\circ\text{C}$
	J		0.01°C	2000°C	$\pm 0.06^\circ\text{C}$	$\pm 0.006^\circ\text{C}$
	K		0.01°C	3000°C	$\pm 0.07^\circ\text{C}$	$\pm 0.007^\circ\text{C}$
	N		0.01°C	3000°C	$\pm 0.10^\circ\text{C}$	$\pm 0.01^\circ\text{C}$
	R		0.01°C	2700°C	$\pm 0.25^\circ\text{C}$	$\pm 0.025^\circ\text{C}$
	S		0.01°C	3500°C	$\pm 0.35^\circ\text{C}$	$\pm 0.035^\circ\text{C}$
	T		0.01°C	550°C	$\pm 0.06^\circ\text{C}$	$\pm 0.006^\circ\text{C}$

Chart continued on next page



Racal Instruments™ 4102

Source/Measure 7.5 Digit Versa-Multimeter



Product Information—Specifications

Chart continued from previous page

Notes:

1. Within one hour of zero, using Relative control. Specified at DMM input terminals.
2. For values between 200pf and 500pf the floor is 0.21% rather than 0.083%.
3. Accuracy is specified for values higher than 5% of the selected range.
4. Within one hour of AC Caps Open Cal operation, and relative correction.
5. Specified for values higher than 5% of the selected range with Aperture > 0.2s.
6. Accuracies are with aperture set to ≥ 0.5 s, using a 4-wire RTD. Measurement accuracy does not include RTD probe error.
7. Accuracies are with aperture set to ≥ 0.5 s. Measurement accuracy does not include thermocouple error.
8. 4102 thermocouple temperature range may be greater than that of the thermocouple device.

4102 Source/Measure and Pulse Mode Accuracy $\pm$ (% of reading + % of range) Note: Accuracy at DMM terminals.

Source Function/ Measure Function	Range	Source Resistance, Compliance Voltage, or Frequency Range	Current/Range	Resolution	1 year 23°C $\pm$ 5°C
Source DC Voltage/ Measure DC Voltage	± 10 V (Closed Loop) ¹	200 Ω Rsource	5 mA	18 bits	0.015+0.0018
	± 10 V (Open Loop)	200 Ω	5 mA	12 bits	1+0.18
Source DC Voltage/ Measure DC Current	± 10 V (Source) ^{1,2}	Typical Settling Time: 3 s	± 10 V	5 mV	1+0.35
	± 24 mA (Measure)		± 24 mA		0.1+0.004
Source DC Current/ Measure DC Voltage	1.25 μ A	4.2 V Vcompliance ⁴	500 pA ⁵	10 nA min. level	1+0.8
	12.5 μ A	4.2 V ⁴	5 nA ⁵	50 nA	1+0.8
	125 μ A	4.2 V ⁴	50 nA ⁵	100 nA	1+0.4
	1.25 mA	4.2 V ⁴	500 nA ⁵	1 μ A	1+0.4
	12.5 mA	1.5 V ⁴	5 μ A ⁵	10 μ A	1+0.4
Source AC Voltage/ Measure AC Voltage ³	900 mVrms (Closed Loop)	30 Hz to 200 kHz	3 mA _{rms} , typical	17 bits	0.1+0.56+ACV spec
	900 mVrms (Open Loop)	10 Hz to 200 kHz	3 mA _{rms} , typical	12 bits	0.8+2.22+ACV spec
	7.2 V _{rms} (Closed Loop)	30 Hz to 200 kHz	3 mA _{rms} , typical	17 bits	0.1+0.07+ACV spec
	7.2 Vrms (Open Loop)	10 Hz to 200 kHz	3 mA _{rms} , typical	12 bits	0.8+0.28+ACV spec
Pulse & Duty Cycle Generator	0V to +10V or 0V to -10V 5 mV resolution	PRI Range: 7.81 Hz to 20 kHz Burst Range: 1 to 32 k	Pulse width: 25 μ s to 64 ms	Duty cycle/PW: 1 μ s steps	

Notes:

1. An aperture of ≥ 133 ms is required for the closed loop mode.
2. See the performance envelope curve (Source V, Measure I section below) for limitations to voltage and current values.
3. Aperture ≥ 166 ms is required for proper closed loop mode usage above 200 Hz. Use higher aperture time for lower frequencies.
4. Compliance voltage is the voltage range in which the current source is linear.
5. Resolution without Trim DAC. The use of the Trim DAC can improve the resolution by a factor of 10, but it has to be set separately since it is not calibrated.



Racal Instruments™ 4102

Source/Measure 7.5 Digit Versa-Multimeter



Product Information—Specifications

DC VOLTAGE MEASUREMENT

Input Resistance

- 240 mV Range: > 10 GΩ
- 2.4 V Range: > 10 GΩ
- 24 V Range: 10 MΩ
- 240 V Range: 10 MΩ
- 300 V Range: 10 MΩ

DC Noise Rejection

- For 50, 60, or 400 Hz, and apertures of 0.160 s or higher:
- Normal Mode Rejection >95 dB
- Common Mode Rejection (with 1 kΩ lead imbalance), >120 dB

AC VOLTAGE MEASUREMENT

Input Resistance

- 1 MΩ, shunted by <100 pF, all ranges

Crest Factor

- 3 at Full Scale, increasing to 7 at Lowest Specified Voltage

Frequency Range

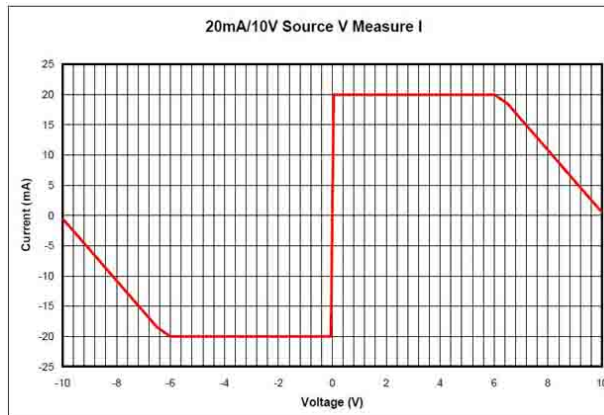
- AC Coupled: 20 Hz to 100 kHz
- DC Coupled: DC to 100 kHz

Typical Settling Time

- <0.5 sec to within 0.1% of final value

AC Voltage Noise Rejection

- Common Mode Rejection, for 50 Hz or 60 Hz with 1 kΩ imbalance in either lead, is better than 60 dB



SOURCE V/MEASURE I

Range of Operation (see plot above)

Initialization

- Cal: Open terminal calibration must be performed once before using this function.
- Set: Set DC Voltage Source ≥ 5 times to arrive at the specified voltage.

SOURCE I/MEASURE V

Range of Operation

- Voltage: ±2.4 V
- Current: 10 nA to 12.5 mA

VOLTAGE SENSING

- Source terminals or Sense Inputs, selectable

Current Resolution

- Normal: 500 pA to 5 μA (ranges 1-5)
- Using Trim DAC: 50 pA to 500 nA (ranges 1-5)

SOURCE ACV/MEASURE ACV

Range of Operation

- Range 1: 30 mV to 900 mVrms
- Range 2: 300 mV to 7.2 Vrms

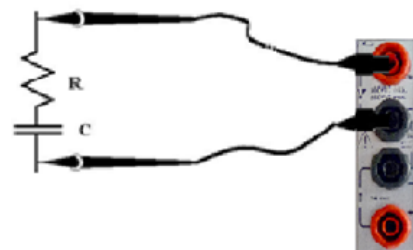
ESR FUNCTION

Description

Measure a resistance that is in series with a capacitance.

Operation

Default operating voltage of 0.5 Vrms. 30 mV to 900 mVrms is available.



Racal Instruments™ 4102

Source/Measure 7.5 Digit Versa-Multimeter



Product Information—Specifications

AC CURRENT MEASUREMENT

Crest Factor

3 at Full Scale, increasing to 7 at Lowest Specified Voltage

RESISTANCE

Offset Compensation

2-wire or 4-wire measurements
Positive or negative polarity voltages
Current x (Resistance + Parasitics)
 $\leq 0.5V$

REAR PANEL I/O

Banana Jacks

V+, V-: Red/Blk Banana Jacks, 300 VDC, 300 VAC max
I+, I-: Red/Blk Banana Jacks, 2 Amps max, 5 Vpk max from V- to I-

J200

Auxiliary I/O: DE9F (D-sub), includes the following I/O:
Guard: G+, G-, 28 VDC max
Sync: Sync/Common
Trigger: Trig/Common

ANALOG BUS I/O

Signal Raceway Connections

Channels: ABUS1-4, 300 VDC/VAC max
Path Resistance: $< 1\Omega$ @ 2 ADC
Thermal EMF: $< 3\mu V$

OTHER SPECIFICATIONS

Reading Rate (user selectable)

0.2 to 20,000 readings per second (rps)
Up to 100 rps, 6½ digits
Up to 1,600 rps, 5½ digits

Overload Protection (voltage inputs)

300 VDC, 300 VAC

Isolation

300 VDC, 300 VAC from Earth Ground

Maximum Input (Volt x Hertz)

8x106 Volt x Hz normal mode input (across Voltage HI & LO)
1x106 Volt x Hz Common Mode input (from Voltage HI or LO relative to Earth Ground)

ENVIRONMENTAL DATA

Temperature

Operating: 0° C to 50° C
Storage: -40° C to 71° C

Relative Humidity

80% RH at 37° C

CONFORMANCE TESTING

Emissions/Immunity

EN61326: 2006 Class B
EN61326: 1997 + A1: 1998, Class A

Safety

Designed to IEC1010-1, Installation Category II (DMM)
EN61010-1: 2001 (Chassis/Extender)
EN61010-1: 1993 + A2: 1995
Pollution degree 1: 300 V
Pollution degree 2: 250 V
Not for connection directly to mains power

RELIABILITY

Switching Time

< 10 ms (includes settling time)

Rated Switch Operations

Mechanical: 1 X 108
Electrical: 200,000 @ 300 Vrms/0.416 A - 125 VA

MTBF

72,511 hours (MIL-STD-217FN2)

Relay Operations Counter

Running total of operations stored in on-board non-volatile memory



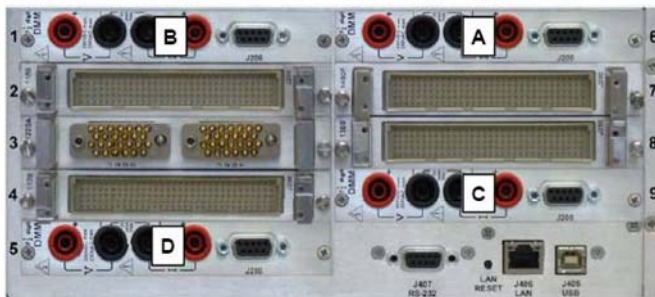
Racal Instruments™ 4102

Source/Measure 7.5 Digit Versa-Multimeter

Product Information—Ordering



9 Signal and Power-Switching Plug-Ins



If you'd like a different configuration, please call the EADS factory.

4 Factory-Installed Options



4102 Ordering Information

PART NUMBER	MODEL/DESCRIPTION
408157-ABCD	Racal Instruments™ 1830 3U Source/Measure Switch System
Factory-installed Option Code 0	No factory-installed option in position
Factory-installed Option Code 2	4102 7.5 Digit Versa-Multimeter, factory installed, signal raceway connections

408157-ABCD[abcd]

1st factory-installed option code 4th factory-installed option code
 2nd factory-installed option code 3rd factory-installed option code

Note 1: “-ABCD” corresponds to plug-in slots 6, 1, 9, 5, as shown above

Note 2: “[abcd]” is optional coding reserved for factory use

Who is EADS North America Test and Services?

- EADS North America Test and Services is a division of EADS North America, Inc., the North American operation of EADS, a global leader in aerospace, defense, and related services.
- A supplier of electronic test and measurement products and services specializing in custom solutions for unique customer requirements
- A leader in the test and measurement industry for almost 50 years
- Home of Racal Instruments™, Talon Instruments™, Tabor Electronics, TYX, and Trig-Tek products

- The full spectrum of our services include:
 - **Instruments:** Commercial Off-The Shelf (COTS), Customized
 - **Integration:** Build-to-Print Systems, Custom Turn-Key Systems
 - **Logistics:** Performance-based Logistics, Training, Parts Support, Obsolescence Management, Worldwide Field Support, Depot Repair, Supply Chain Management
 - **Consulting:** Design, Improvement, System Specifications, System Retrofit and Modification
 - **Software:** ATLAS ATE, Instrument Drivers, System Software, Application-specific Software, Test Program Sets

Racal Instruments™ 4102

Source/Measure 7.5 Digit Versa-Multimeter



Product Information—Ordering

Ordering Examples—Note: ABCD are the factory-installed option codes in ascending numerical order. Unused digits are "0."

PART NUMBER	MODEL/DESCRIPTION
408157-2200	Model 1830 with a 4102 installed in slot 6, and a 4102 installed in slot 1
408157-2220	Model 1830 with a 4102 installed in slot 6, a 4102 installed in slot 1, and a 4102 installed in slot 9

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EADS North America Test and Services
1.800.722.2528 / 1.949.859.8999
sales@ts.eads-na.com



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