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What is the difference among ZERO:AUTO:OFF, ZERO:AUTO:ONCE and ZERO:AUTO:ON?

When autozero is enabled or ON, the Model 2110 performs self-calibration at a regular interval of 2 seconds. This auto-zero action will not happen in parallel with an on-going measurement. Similarly, a measurement will not start until an autozero operation has completed.

Autozero off and once behave identically. The autozero action only happens once when either ZERO:AUTO:OFF or ZERO:AUTO:ON is issued. No subsequent autozero operation will occur until another ZERO:AUTO:OFF or ZERO:AUTO:ON command is issued.

Why is my DCV ratio measurement display "over loaded"?

In a DCV ratio measurement, the "SENSE" inputs are used to measure the reference voltage. The reference voltage should be limited to 1.2V or below. Otherwise, an overload message will appear on the display.

What are the reading speeds for buffered measurements at different NPLCs?

NPLC	Samples	Rate [Hz]
0.001	2000	49199.8
0.006	2000	9968.0
0.02	2000	3121.8
0.06	2000	1020.0
0.2	2000	301.2
0.6	1000	100.2
1	600	60.0
2	300	30.0
10	60	6.0
100	6	0.6

What is the bus latency and speed difference between GPIB and USB?

	*STB? [ms]	READ? (0.001 PLC) [ms]	READ? (0.2 PLC) [ms]	FETC? (2000 Samples) [kB/s]
GPIB	0.425875	0.989525	4.2998	25.9775
USB	2.989	2.9945	4.816775	151.07

What is the Interface transfer rate?

	*STB? [ms]	READ? (0.001 PLC) [ms]	READ? (0.2 PLC) [ms]	FETC? (2000 Samples) [kB/s]
GPIB	0.425875	0.989525	4.2998	25.9775
USB	2.989	2.9945	4.816775	151.07

About the software timer

Timing was performed with QueryPerformanceCounter on a Windows 7 PC (x64), Xeon E5620 @ 2.4GHz, 1/QueryPerformanceFrequency = 428ns

What is the latency from EXT Trig to VMC Out?

NPLC	TRG -> VMC time [s]
0.001	1.21E–04
0.006	1.82E–04
0.02	4.50E–04
0.06	1.10E–03
0.2	3.44E–03
0.6	1.01E–02
1	1.68E–02
2	3.35E–02
10	1.67E–01
100	1.67E+00

Can I enable NULL and AVG simultaneously?

No. Only one Math function can be enabled at any time.

What thermocouple types are supported by Model 2110?

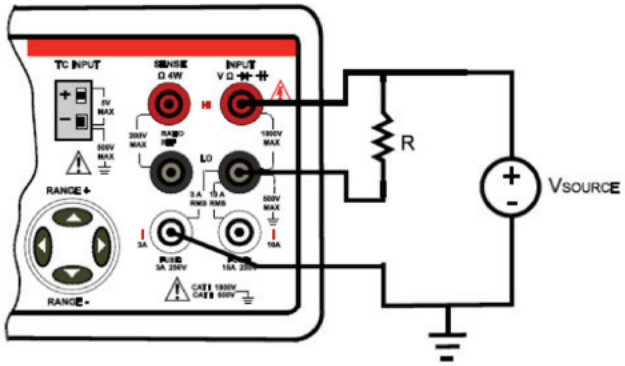
Model 2110 supports thermocouple sensor types B, C, E, J, K, N, R, S and T.

Can Model 2110 perform both DCV and DCI measurements at the same time?

Yes. To simultaneously measure DCI and DCV from the same input source, you have to use three test leads, as shown below. The voltage and current measurements share the same common lead at the INPUT LO terminal. However, the resistance of the external LO test lead and the resistance of the internal current measurement LO circuit affect measurement accuracy. The resistance of the internal current measurement LO circuit is approximately 3mΩ. If, for example, the LO test lead is 7mΩ, the total common resistance is 10mΩ. If 1A is being measured by the instrument, the voltage would be affected as follows:

1A × 10mΩ = 10mV

Therefore, 10mV of error is introduced into the voltage measurement.



What are all the dual measurement combinations available on the Model 2110?

Secondary Measurement Functions

Primary Measurement Function	DCV	DCI	2W	4W	ACV	ACI	FREQ_V	PER_V	FREQ_C	PER_C	CAP	TEMP	TCO	CONT	DIODE
DCV		✓			✓		✓	✓					✓		
DCI	✓				✓	✓	✓	✓	✓	✓			✓		
2W													✓		
4W													✓		
ACV	✓	✓					✓	✓					✓		
ACI		✓							✓	✓			✓		
FREQ_V	✓	✓			✓			✓					✓		
PER_V	✓	✓			✓		✓						✓		
FREQ_C		✓				✓				✓			✓		
PER_C		✓				✓			✓				✓		
CAP													✓		
TEMP													✓		
TCO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
CONT															
DIODE															

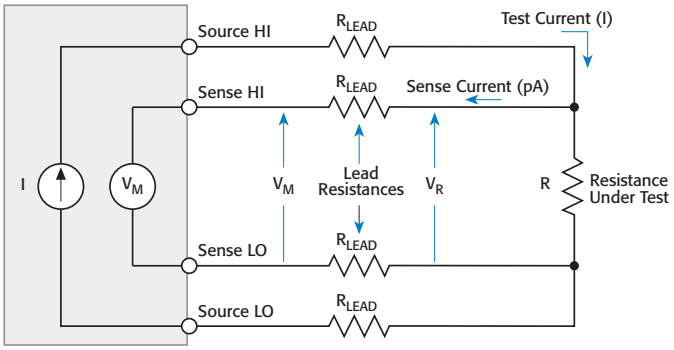
What is the difference between a 2-wire and a 4-wire resistance measurement?

The main measurement issue with the two-wire method, as applied to low resistance measurements, is that the total lead resistance (R_{LEAD}) is added to the measurement. Since the test current (I) causes a small but significant voltage drop across the lead resistances, the voltage (V_M) measured by the meter won't be exactly the same as the voltage (V_R) directly across the test resistance (R), and considerable error can result. Typical lead resistances lie in the range of 10mΩ to 1Ω, so it's very difficult to obtain accurate two-wire resistance measurements when the resistance under test is lower than 100Ω. For example, using test leads with a 500mΩ combined resistance to do a two-wire resistance measurement on a 500mΩ resistor would result in a 100% measurement error in addition to that of the instrument.

Four-Wire (Kelvin) Resistance Measurements

Due to the limitations of the two-wire method, the four-wire (Kelvin) connection method shown in the figure below is generally preferred for low resistance measurements because it reduces the effect of test lead resistance. These measurements can be made using a DMM, SourceMeter® instrument, or a separate current source and voltmeter. With this configuration, the test current (I) is forced through the test resistance (R) through one set of test leads, while the voltage (V_M) across the DUT is measured through a second set of leads (sense leads). Although some small current (typically less than 100pA) may flow through the sense leads, it is usually negligible and can generally be ignored for all practical purposes. The voltage drop across the sense leads is negligible, so the voltage measured by the meter (V_M) is essentially the same as the voltage (V_R) across the resistance (R). Consequently, the resistance value can be determined much more accurately than with the two-wire method.

DMM or Micro-ohmmeter



V_M = Voltage measured by meter
V_R = Voltage across resistor (R)
Because sense current is negligible, $V_M = V_R$
and measured resistance = $\frac{V_M}{I} = \frac{V_R}{I}$

Model 2110 5½-Digit Dual Display Digital Multimeter

Frequently Asked Questions

How are NPLC, resolution and digits related on the Model 2110?

Display Digits	Integration Time (PLC)	Measurement resolution (remote operation)
4½	0.001	0.0003 × full scale range
4½	0.006	0.0002 × full scale range
4½	0.02	0.0001 × full scale range
4½	0.06	0.00005 × full scale range
5½	0.2	0.00001 × full scale range
5½	0.6	0.000005 × full scale range
5½	1	0.000003 × full scale range
5½	2	0.000002 × full scale range
5½	10	0.000001 × full scale range
5½	100	0.000003 × full scale range

Please refer to the Model 2110 Reference Manual for more details.

What is the NPLC behavior under varying power line frequencies?

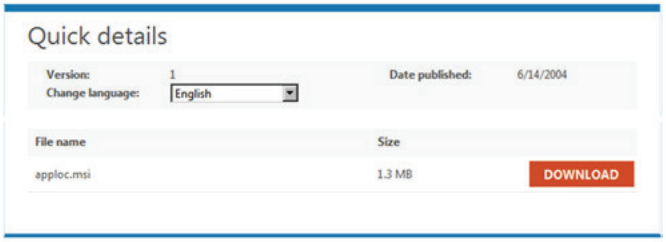
Power line frequency is detected once, when the 2110 is first turned on, the integration period for the two fastest NPLC settings is fixed. The 0.001 setting has a fixed integration period of 20µs. The 0.006 setting has a fixed integration period of 100µs.

The integration period for all other NPLC settings is calculated by multiplying the reciprocal of the line frequency by the NPLC value. For example, with a line frequency of 50 Hz and NPLC setting of 0.02 the integration period is (1/50) · 0.02 = 400µs.

Why are characters not displaying properly when I set the KI-Tool language to Chinese?

To display Chinese, please follow the link below and install Microsoft AppLocale Utility.

http://www.microsoft.com/en-us/download/details.aspx?id=13209



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