DMMCheck Plus Voltage Reference

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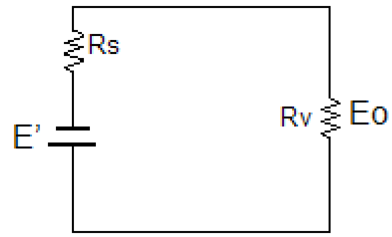


Factory cal

Factory calibration.

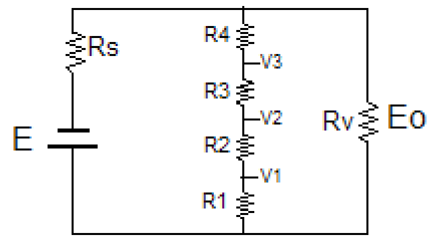
$Rs := 25$ Source resistance

$Rv := 10^7$ DMM calibration resistance

$Eo := 5$ Cal value

E' is adjusted to read Eo = +5.0000 V

Re - calibration with divider, with load Rv



Re-cal with R1-R4

E is re-adjusted to read Eo = +5.0000 V

$R1 := 100.04$ $R2 := 1000.78$

$R3 := 10002$ $R4 := 100096$

$R := R1 + R2 + R3 + R4$

$$Eo = E\cdot\frac{\frac{Rv\cdot R}{Rv+R}}{\frac{Rv\cdot R}{Rv+R}+Rs}$$

$$Eo = R\cdot Rv\cdot\frac{E}{(Rv\cdot R + Rs\cdot Rv + Rs\cdot R)}$$ Eq. 1

Solve for E:

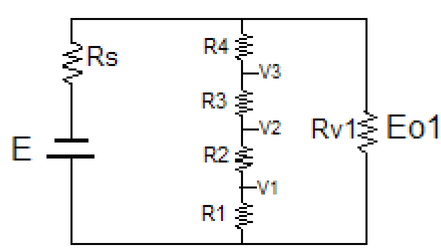
$$E := \frac{Eo}{R\cdot Rv}\cdot(Rv\cdot R + Rs\cdot Rv + Rs\cdot R)$$ Eq. 2

$E = 5.001137$ New E value to read Eo = +5.0000 V

The thevenin resistance of source E is ~ Rs, since R and Rv >> Rs

Eo1 with a different load: Rv1, the voltmeter resistance

$Rv1 := 10^6$



$$RTh4 := \frac{R\cdot Rs}{R + Rs}$$ $RTh4 = 24.994$ Eq. 3 Thevenin resistance

$$VTh4 := E\cdot\frac{R}{R + Rs}$$ $VTh4 = 5.000012$ Eq. 4 Open circuit voltage

$$Eo1 := VTh4\cdot\frac{Rv1}{Rv1 + RTh4}$$ $Eo1 = 4.999888$ Eq. 5 Voltage at Eo1

Voltage at V3, with RV1 connected at V3:

$$RTh3 := \frac{(R1 + R2 + R3)\cdot(R4 + Rs)}{R + Rs}$$ Eq. 7 Thevenin resistance $RTh3 = 9994.491$

$$VTh3 := E\cdot\frac{(R1 + R2 + R3)}{R + Rs}$$ Eq. 8 Open circuit voltage $VTh3 = 0.499234$

$$V3 := VTh3\cdot\frac{Rv1}{Rv1 + RTh3}$$ Eq. 9 Voltage at V $V3 = 0.494294$

Voltage at V2, with RV1 connected at V2:

$$RTh2 := \frac{(R1 + R2)\cdot(R3 + R4 + Rs)}{R + Rs}$$ Eq. 10 Thevenin resistance $RTh2 = 1089.925$

$$VTh2 := E\cdot\frac{(R1 + R2)}{R + Rs}$$ Eq. 11 Open circuit voltage $VTh2 = 0.049498$

$$V2 := VTh2\cdot\frac{Rv1}{Rv1 + RTh2}$$ Eq. 12 Voltage at V2 $V2 = 0.049444$

Voltage at V1, with RV1 connected at V1:

$$RTh1 := \frac{(R1)\cdot(R2 + R3 + R4 + Rs)}{R + Rs}$$ Eq. 13 Thevenin resistance $RTh1 = 99.95$

$$VTh1 := E\cdot\frac{(R1)}{R + Rs}$$ Eq. 14 Open circuit voltage $VTh1 = 0.004498$

$$V1 := VTh1\cdot\frac{Rv1}{Rv1 + RTh1}$$ Eq. 15 Voltage at V1 $V1 = 0.004498$

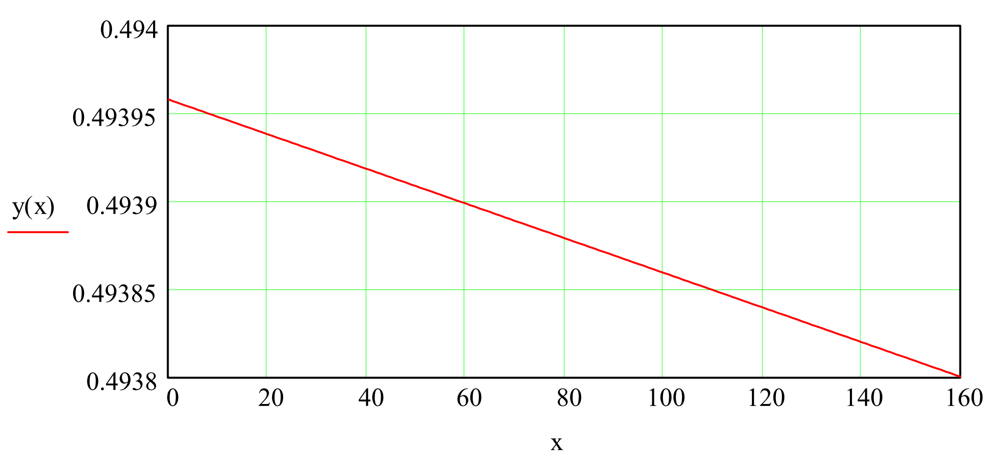
Effect of Input Capacitance at AC 100 Hz on V3 voltage

From Rdg vs pF.xls

$$y(x) := -9.848127\cdot 10^{-7}\cdot x + 0.4939582$$

y= -9.848127E-07x + 4.939582E-01

$x := 0, 1 .. 160$



$y(60) = 0.4939$

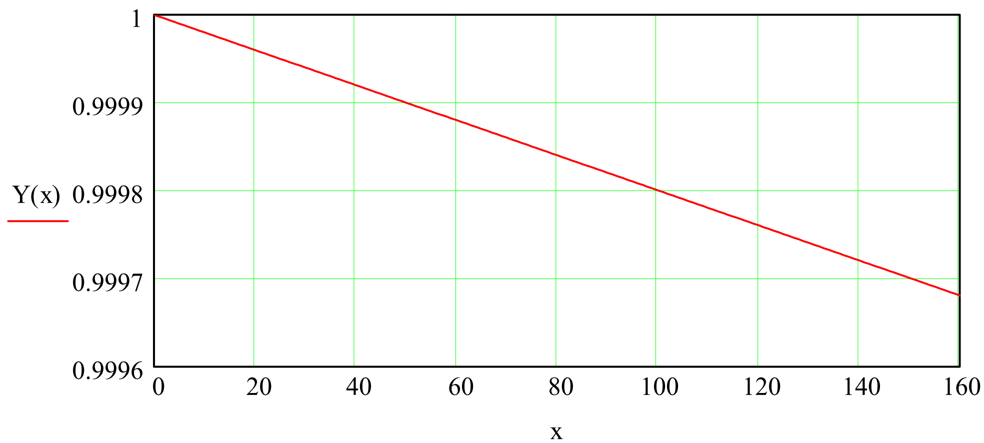
$y(x) := -9.848127 \cdot 10^{-7} \cdot x + 0.4939582$

$Y(x) := \frac{-9.848127 \cdot 10^{-7}}{y(0)} \cdot x + \frac{0.4939582}{y(0)}$

$\frac{-9.848127 \cdot 10^{-7}}{y(0)} = -1.993717 \times 10^{-6}$

$Y(x) := -1.993717 \times 10^{-6} \cdot x + 1$

$\frac{0.4939582}{y(0)} = 1$



Changed the sign of the slope
YY (x) is the mult factor to use to correct for the input capacitance

$YY(x) := \frac{9.848127 \cdot 10^{-7}}{y(0)} \cdot x + \frac{0.4939582}{y(0)}$

$\frac{0.4939582}{y(0)} = 1$

$YY(x) := 1.994 \cdot 10^{-6} \cdot x + 1$